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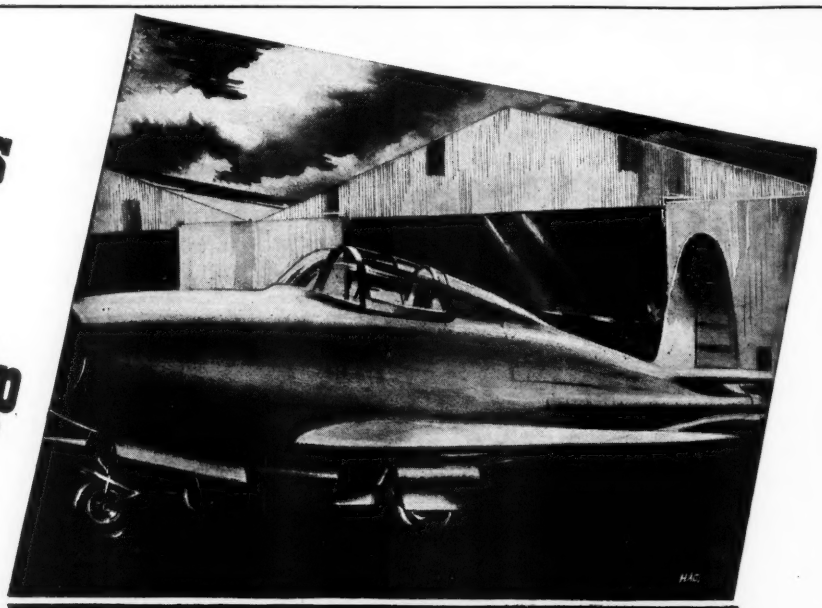

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The Outlook

A Gloomy Report

MR. LEO CROWLEY has submitted a report to the Military Affairs Committee of the U.S. Senate in which he made some observations which will certainly surprise the world. He alleges that Germany has the better part of her economic and industrial strength to-day, though she could not marshal it immediately for war. He admits that a detailed assessment has not yet been made, but still asserts that if Germany were left to her own devices she could be far better prepared for war in five years than she was in 1939.

To those who have seen or heard about the terrific results of Allied bombing, this estimate will come as a shock. Mr. Crowley agrees that this bombing accomplished its purpose (for Germany could not make war at once, even if left alone); but he maintains that it did not reduce most of the German plants to utter ruin or eliminate permanently the country's war potential. His report gives a list of industries which are still in operating condition or could rapidly be made so. Among them are dyes and chemical equipment, virtually all the great iron and steel furnaces, nitrogen, coal and tar, synthetic textiles, rubber, petroleum products, and aluminium. As for machine tools (which are "much more important in modern war than soldiers") the report says that to-day Germany, except for the United States, is "the outstanding armament machine shop of the world."

If this report is in the main correct, it is as well that the facts should be known at once, so that due precautions can be taken. The occupation of Germany will obviously have to be a long one, and there must be careful supervision of the way in which German industry is allowed to develop. Subject to these safeguards, it would be folly to prevent Germany from again becoming an industrial nation, able and willing to export and import, and to circulate money. Her Nazi leaders are said to have aimed at reducing all conquered countries to the state in which they could only turn out agricultural products, while all manufacturing activities were concentrated in Germany herself. The leaders of the Allies are not so foolish as that. But they must be careful to see that war industries which the bombing has spared are not allowed to develop into a menace; and we feel sure that they are quite alive to the need to follow such a policy.

An Engine Era Passing

IT appears likely that aircraft engines of the size of the Bristol Centaurus (described on pages 13-17) will represent the largest of the reciprocating type to be built and that in the next step-up in power the gas turbine will become the customary prime mover. This does not mean that there will not be development of the standard types for quite a long while to come. It is probable, with its whole development life in front of it, that the Centaurus, for instance, will eventually give well over 3,000 h.p.

When the gas turbine comes into its own it will be interesting to see how divergent the products of each country and manufacturer will become. In the past each concern has specialised on the particular form of reciprocating engine. So much so that cylinder layouts and engine manufacturers' names have become almost synonymous. Liquid-cooled vees, sleeve-valved radials, liquid-cooled and sleeve-valved Hs and in-line and vee air-cooled engines all have their well-known exponents.

It is difficult to see how there can be any such big differences in gas turbine design. There will, of course, be plenty of scope for minor differences and refinements.

All research and experience will be of equal value to all the engine firms. In a co-operative effort wherein all experience and knowledge was pooled, each concern would stand to gain four or five times that which they give, and ensure for Britain the world lead we already have in the new engine era.

Unfortunately, each firm is not in a position to contribute an equal amount to such a pool, and it is understandable that those who are more advanced would not be prepared to divulge the results of their research.

It may be that internal competition will have the stimulating effect necessary to produce the requisite high standard of design. This, however, must entail much wasted time and labour which can be ill-spared in these days of intense international competition for export trade.

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Civil Flying in India

INDIA is a country where the geography and climate simply clamour for an extensive use of air transport; while the population, being mainly agricultural and short of cash, suggests a cautious policy of advance. There are a few very rich men in India and a certain number of wealthy commercial firms who could afford to pay high fares for speedy transport over the generous distances of India. There is also great need for the speedy transport of mails between important points; but the important centres in India are few and far between.

The Government of India has issued a statement outlining its policy on civil flying in the immediate post-war years. In brief, it is to promote the development of air transport, internal and external, by a limited number of sound and reliable private commercial organisations. In some cases the Government will take a financial interest, but not a controlling interest. In particular cases the Central Government, a Provincial Government, or an Indian State may operate services itself.

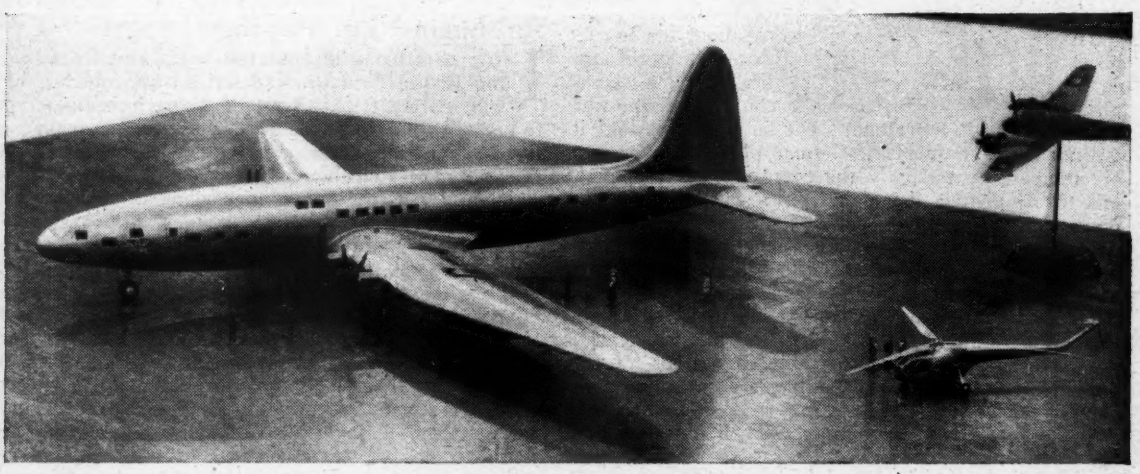
The chief hold which the Central Government will retain will be through a Licensing Board, which will grant what is in effect a monopoly to a certain firm over a given route, so as to prevent uneconomic competition. Monopolies in general may be objectionable; but for a nascent industry in such a country as India they are almost unavoidable.

The total route mileage planned is 11,000, and it is proposed that the aircraft should carry from 12 to 20 passengers as well as mails and freight. A provision of so many seats on a daily service sounds optimistic, but may be justified by experience. For as long as can be foreseen the passenger traffic will be confined to the classes mentioned above, plus a tourist traffic during the cold weather.

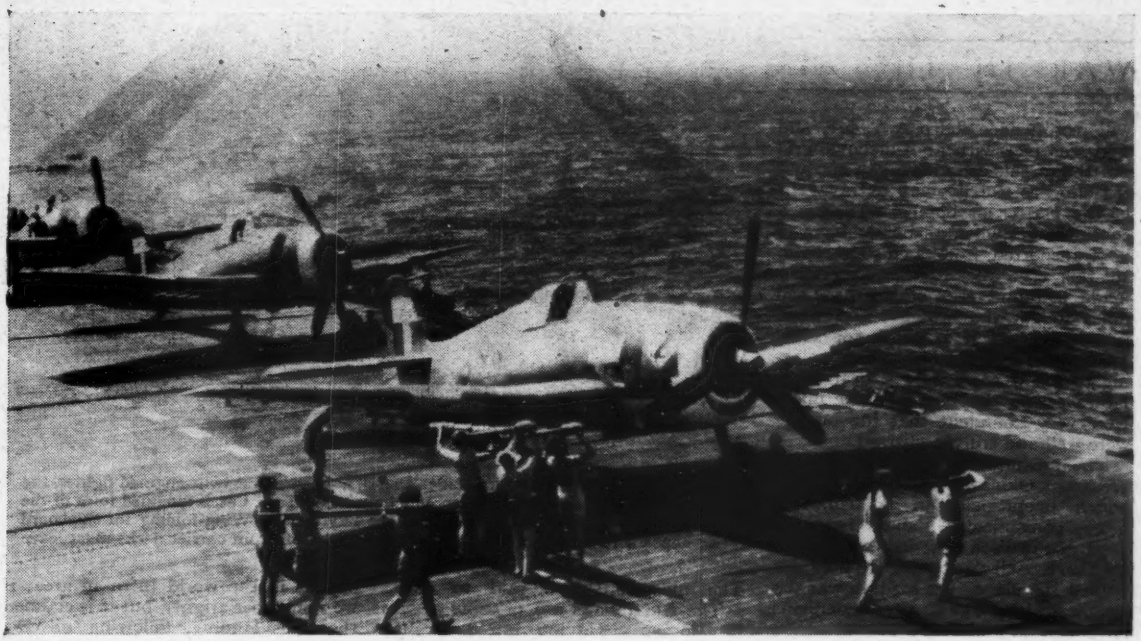
More About Burma

FOLLOWING on General Slim's recent account of the campaign in Burma, an account of the air side of the war was given last week by Air Vice-Marshal the Earl of Bandon, D.S.O. It was pleasant to hear him pay generous tributes to the work of the Navy and the Army, and it was interesting to learn that aircrews were sent forward with the ground troops so that they could learn to understand the difficulties of the Army.

Tactically, he was inclined to rate the close air support given as even more important than the air supply. It was that close support which made rapid advances possible, and so created the need for the stupendous amount of supply which was given. The Japanese were so thoroughly beaten in the air that neither our dive-bombers nor our supply machines had to worry about interference; but Lord Bandon could not say if the enemy was merely frightened of our Spitfires (he thought he was), or if he was deliberately trying to save his fighters for another day.



BRISTOLS OF THE FUTURE: Scale models of the 224-seater Brabazon I and the four-seater Bristol helicopter. Power for the prototype Brabazon I will be provided by eight Centaurus engines geared in pairs to drive four contra-rotating airscrews. Production machines are expected to have gas turbines. Span 230ft; length 177ft.; gross weight 250,000 lb.; tare 130,600 lb. The helicopter is designed to carry four persons, with 100 lb. of luggage, at 100 m.p.h. A 450 m.p.h. air-cooled radial engine is housed under the cabin. All-up weight 4,500 lb.



THE CAT'S WHISKERS: Naval Air Arm armourers loading rocket projectiles on to Hellcats on a British escort carrier operating with the East Indies Fleet.

WAR in the AIR

Siam Bridges Bombed : Allies Hammer Japan by Air and Sea

GEOGRAPHY is a subject in which the earnest student never stops learning, and the late and present wars have brought home to that worthy person how incomplete his previous studies have mostly been. He has had to learn the names of many hitherto unheard-of Russian cities, and has been surprised to read how large and important many of them are. Then came Polish names, and even one Russian newspaper was humorously satirical about the difficulty of spelling and pronouncing some of them. The Burma campaign set seekers after knowledge looking up maps to locate names which they had read in Kipling's poems. Now comes the need to study the geography of Thailand (formerly Siam).

The enterprising R.A.F. is responsible for most of these latest geographical headaches. Last week it bombed to destruction (so it is hoped) two important bridges at Kanchanaburi. How many of our readers, we wonder, had ever known before of the existence of such a place? The helpful Public Relations Department of the Air Ministry gives the information that it is 80 miles west of Bangkok (well, we had all heard of Bangkok before) and that the bridges in question crossed the Meklong River, which is now swollen by monsoon rains and very turbulent. All supplies for the remnants of the Japanese Army in Burma have to be got across the Meklong somehow or other; and likewise, if those remnants are to withdraw on an organised basis from Lower Burma into Thailand, they, too, must get across the Meklong. So the bombing of the two bridges was an important affair.

Bombing bridges is a task which the R.A.F. does not really enjoy. It

...THEIR EXITS AND THEIR ENTRANCES: The hole made in the bottom of the hull by a piece of a 12,000 lb. bomb which exploded inside the 45,000 ton German battleship Tirpitz during the attack by R.A.F. Lancasters last November. The Tirpitz turned over twenty minutes after being hit.

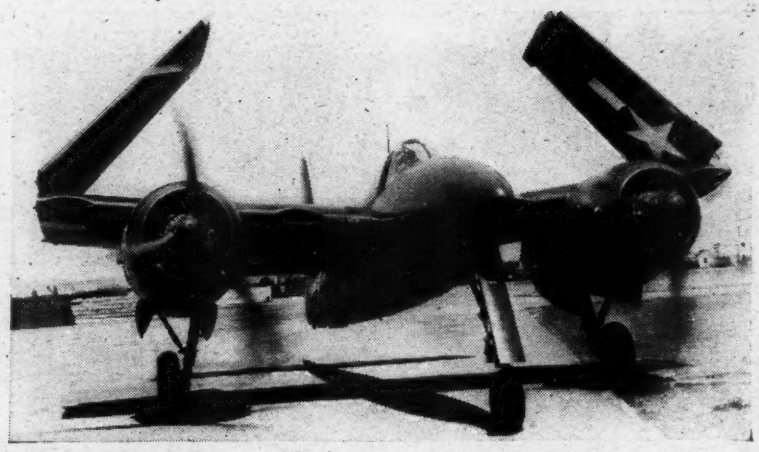
WAR IN THE AIR

will readily face sharp A.A. fire, and that was met with at Kanchanaburi; but the targets are difficult to hit, and the effort is usually very extravagant in the matter of bombs. That is a consideration when all bombs have to be transported from a distant base. In this case the R.A.F. Liberators made a round trip of nearly 2,000 miles to get the bridges; and when you have carried a bomb for some 1,000 miles it must be very disappointing to see it score only a near miss. However, on this occasion, the pilots were very confident that the bridges were well and truly destroyed.

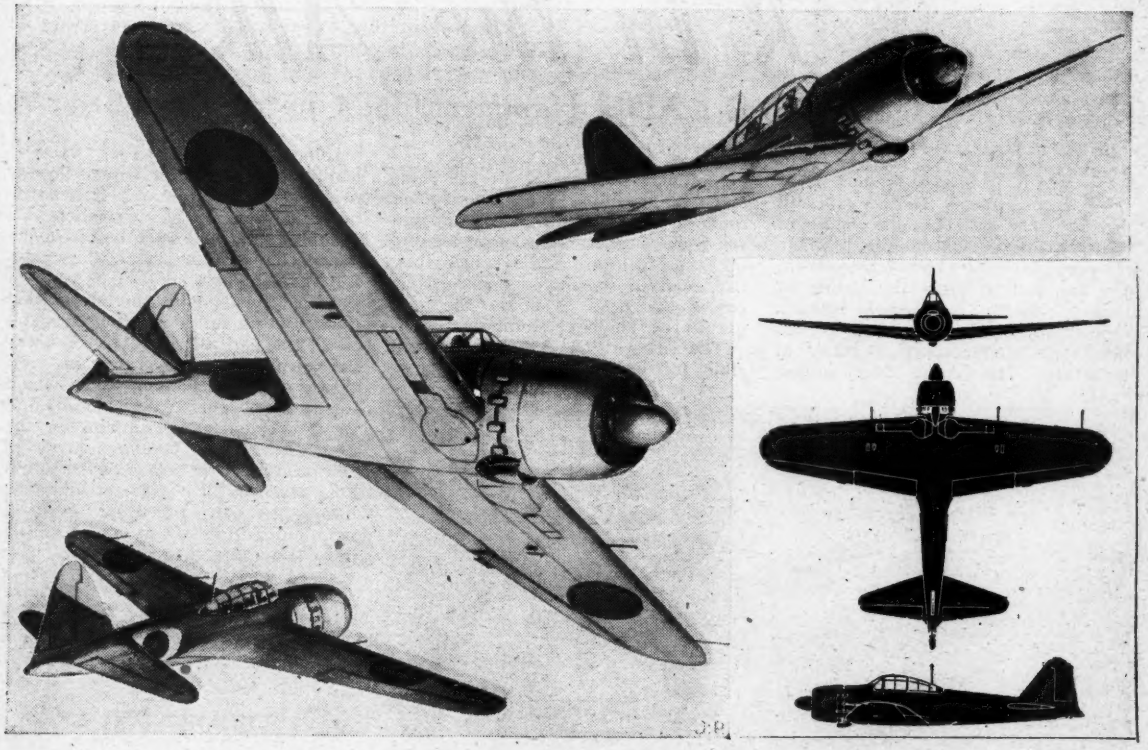
The pressure on Japan grows ever greater. Okinawa is a base from which operations can be launched most conveniently, and that the Japanese realised that fact was shown by the tenacity with which they defended the place. Its capture was the toughest job which the Americans have had to undertake.

The Superfortresses are gathering round the doomed aggressor like eagles to their prey. Last week nearly 600 of them dropped 4,000 tons on five Japanese centres of industry. The most intensive raid to date.

The Australians are pressing ahead in Borneo. Having seized Brunei Bay and the oilfields in the neighbourhood, they have made a new landing in the south-west at Balikpapan, after an intensive naval and air bombardment. Borneo is one of the largest islands in the world (fifth in area, if we remember aright), but it is claimed that this landing, following on the success in the north, has crushed the Japanese key positions in the island. If Borneo is in Allied hands, then the Japanese in Java and Sumatra are cut off from their base.



HIGH PERFORMANCE AT SEA: The U.S. Navy's first twin-engined fighter, the Grumman Tiger Cat is now in production. The Tiger Cat, a modified form of the XP-50 was originally developed from the Skyrocket. Wing-folding for shipboard use appears to be a problem. Landing and take-off from carrier decks must leave little room for error.



ZEKE 52.—Latest development of the series of Mitsubishi single-seaters which began with the Navy 00 (the original Zero). This Jap fighter is powered by a 14 cylinder Nakajima Sakae 21 engine. This two-row, air-cooled radial is fitted with a 2-speed supercharger and develops 1,100 h.p. at sea-level. Armament comprises two 7.7 mm. machine guns and two 20 mm. cannon. Intended to operate from carriers, the Zeke 52 has the shorter wing-span of the clipped Hamp (model 32) but its tips are rounded. With its light weight of less than 6,000 lb. all-up (it has no armour) the shorter span makes it extremely manœuvrable, but its top speed of about 370 m.p.h. at 2,000ft. is lower than that of any of the first-line carrier fighters of the Allies to-day. Range is about 1,500 miles and rate of climb 2,800ft./min.

HERE AND THERE

Congratulations

PHILIP G. LUCAS, G.M., F.R.Ae.S., chief test pilot to Hawker Aircraft, Ltd., has been appointed to the company's board of directors. He joined Hawkers in 1931 as assistant to "George" Bulman, and thus follows his old chief on to the board.

Petrol in Plenty

SIR MILES THOMAS, the Nuffield vice-chairman, has told Belfast Chamber of Commerce that stocks of petrol in Britain are very high and there was no reason why the basic ration to motorists should not be trebled.

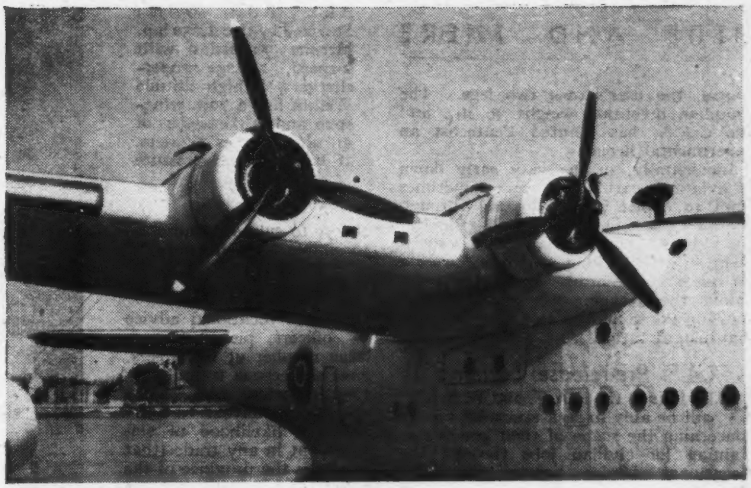
In this case there seems to be very little reason why petrol should not also be made available for flying clubs and owner-pilots.

Indeed, there is a fair chance that petrol may be released from rationing completely when the existing coupon period expires.

Making Whoopee!

WHAT has been described as "one of the most lavish parties yet given in liberated Europe" marked the R.A.F.'s official farewell to Brussels.

The Burgomaster of the Belgian capital, M. Van de Meulebroeck, presented a specially designed standard to the R.A.F. and bronze plaques to Air Marshal Sir Arthur Coningham and Air Vice-Marshals Basil Embry and Harry Broadhurst as a sign of appreciation of the part played by the R.A.F. in the liberation of his city.



MORE POWER TO IT: The Sunderland Mk. V. differs from the Mk. III chiefly in being fitted with 1,200 h.p. 14-cyl. Pratt and Whitney Twin Wasps instead of 1,000 h.p. 9-cyl. Bristol Pegasus XVIIIs, with a consequent all-round improvement in performance.

Sir R. Fairey Returns

SIR RICHARD FAIREY, who recently retired from the position of director-general of the British Air Commission in Washington, has now resumed the chairmanship of the Fairey Aviation Co., Ltd. In 1940, being already in the U.S., he joined the British Purchasing Commission as adviser to its air representative, Sir Henry Self.

Sir Clive Baillieu, who has been acting as chairman of the company since 1943, has retired from that position and from the board.

The Halifax VI

SOME more details of the Halifax VI bomber have just been released by Handley Page, Ltd., and the M.A.P. External appearance, wing span and armament are the same as those of the later version of the Halifax III, but the mark VI is powered by 1,800 h.p. Bristol Hercules 100 engines instead of 1,650 h.p. Hercules XVI engines.

Maximum true airspeed of the Halifax VI is 328 m.p.h., bomb-load 14,500 lb., and range approximately 3,000 miles. All-up weight has been increased to 68,000 lb., while take-off, cruising speed and ceiling have been much improved.

Memorial Service

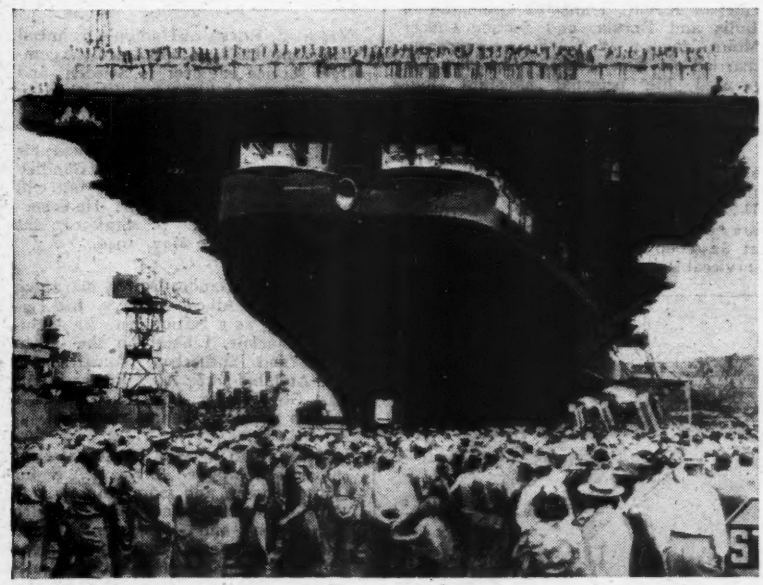
A MEMORIAL service for the passengers and crew of the York in which Air Chief Marshal Sir Trafford and Lady Leigh-Mallory were on their way to S.E.A.C. last November, and which crashed with the loss of all lives, was held last week in Westminster Abbey.

Air Chief Marshal Sir Edgar Ludlow-Hewitt represented the King, and the service was also attended by members of the Air Council, Army Council, the Admiralty Board, and representatives of the Dominion and Allied Air Forces.

The Hoppicopter

THE above name has been coined by Horace Pentecost, a young Boeing engineer at Seattle, who is reported to have obtained "encouraging results" with a device which is surely the very essence of that American term, the "personal plane." You don't sit in it, you wear it!

The hoppicopter is, in fact, attached to the user's back by a species of parachute harness and comprises a 20 h.p. 2-cylinder engine driving rotor blades which whirl above his head. A control column is held in the right hand and a throttle lever is arranged convenient to the left hand. The undercarriage is, of



DECKED OUT FOR THE OCCASION: This view of the U.S. Navy's 28th new aircraft carrier, the U.S.S. *Lake Champlain*, taken at the launching ceremony, accentuates the aptness of the term "flat-top." Beauty is indeed skin-deep!

HERE AND THERE

course, the user's own two legs. The complete invention weighs 90 lb., and the C.A.A. has granted Pentecost an experimental licence.

Incidentally, in the very early dawn of aviation, cartoonists were sometimes wont to depict people floating through the air by means of just such a device, the inference being that those experimenting with "flying machines" were a bit queer in the head. But many years before then, even, old prints existed showing the same idea as a peep into the dim distant future.

R.A.F. Pre-release Training

ALL ranks of the R.A.F. and W.A.A.F. will be able to seek specialist advice concerning the scope of their pre-release training for civilian jobs through the Vocational Advice Service, the Air Ministry announces.

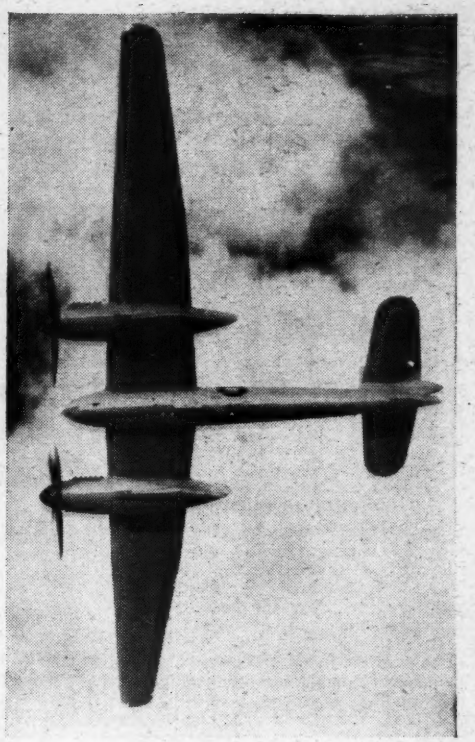
It has previously been stated that the Air Force will provide basic training for certain civilian occupations, including conversion or refresher training. Now they will be able to request an interview with a specially trained service officer, who will advise them on the qualifications required for civilian occupations, the nature of the work, the training required, and the personal qualities likely to make for success in the trade chosen.

The airmen or airwomen may also choose to submit themselves to simple aptitude tests.

Chosen for the Job

THESE vocational advice officers, picked from a large number of volunteers, have undergone training for their important work. They are not permitted to forecast the likelihood of employment in any trade (that advice is the province of the Ministry of Labour), but will provide a valuable filter to prevent men and women training for careers for which they are obviously unsuitable.

Advice officers, of both sexes, will travel throughout the country in small teams, and all non-regular officers, airmen and airwomen will have the right to seek an interview.



ALL FOR ONE: Powered by two 1,650 h.p. Merlins (70 series) with 2-speed, 2-stage superchargers, the high-altitude Welkin has a 70ft. wingspan and is the biggest of all single-seater fighters. It has a heated pressure cabin.

News in Brief

U.S.A.A.F. Transport Command has started daily scheduled air services from Paris to Copenhagen and Oslo.

* * *

R.A.F. officers and men in release groups 1 to 5 were on their way to Great Britain from India within three weeks of VE-Day.

* * *

Ballot papers from members of H.M. Forces serving overseas were flown back to Britain from almost all parts of the world in time for Polling Day to-day.

* * *

More than 6,000 R.A.F. aircraft in distress were helped to a safe landing by the Royal Observer Corps from 1942 to the end of the war in Europe.

* * *

Mustangs based on Iwojima recently made their longest combat mission, a flight of 1,645 miles, to attack airfields north-east of Tokyo.

* * *

A thousand Belgians are to join the R.A.F. 2nd T.A.F. for police duties in the British-controlled sector of Germany, in accordance with the agreement between Shaef and the Belgian Ministry of National Defence. They will be known as the Belgian Auxiliary Air Police Service.

* * *

Air Vice-Marshal C. M. McEwen, who recently left England with the last of the R.C.A.F. Bomber Group to fly home, and was to have commanded the R.C.A.F. in the Pacific, has had to relinquish his command because of a reduction in his medical category. His place is to be taken by Air Vice-Marshal C. R. Slemon, of Winnipeg.

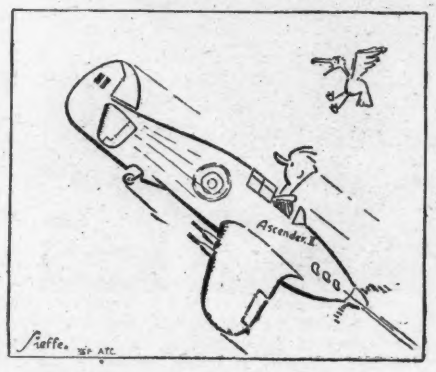
Hundreds of thousands of photographs taken by the German air reconnaissance service before and during the war have been found packed in 300 big wooden cases discovered in a farm cellar near Berchtesgaden, according to a recent report on the New York radio.

* * *

Air Vice-Marshal C. E. Neville Guest, chief of R.A.F. Transport Command in India and Burma, and Section Officer Moira Cameron, W.A.A.F., were recently married in New Delhi. She was appointed his personal assistant four months ago.

* * *

More than 100 Flying Fortresses and Liberators which made forced landings in Sweden during the four years of U.S.A.A.F. operations over Germany are being flown back to Britain. Valued at $250,000 each, they have been kept serviceable by their interned crews.



Mr. L. Rumley has joined the board of Messier Aircraft Equipment, Ltd., as technical director.

* * *

Major H. R. Kilner, M.C., managing director (aviation) of Vickers-Armstrongs, Ltd., has joined the board of Vickers, Ltd., and Mr. L. I. G. Leveson, B.Sc., has been appointed a director of Vickers-Armstrongs, Ltd.

* * *

Mr. A. C. Priest, of Dunlop's technical department, has been appointed the company's service engineer in Sweden, and will be taking up his new duties there in the near future.

* * *

Mr. G. R. Volkert has resigned his position as chief designer to Handley Page, Ltd., owing to ill-health, but will continue to act as consultant. He is succeeded by Mr. R. S. Stafford, his assistant chief since May, 1940.

* * *

Mr. E. L. Gander Dower, managing director of Allied Airways, Ltd., is opposing, as a Nationalist, Sir Archibald Sinclair, Liberal, in the Caithness and Sutherland constituency. Sir Archibald was Air Minister in the last Government, and Allied Airways routes traverse the area contested.

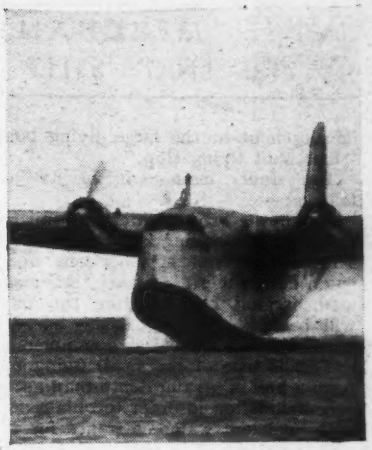
* * *

More than 14,000 Bristol aircraft have been supplied to the R.A.F. for war purposes, and more than 100,000 Bristol aircraft engines, complete with auxiliaries and equipment, have powered no fewer than 28 different types of operational and trainer aircraft. These facts were given by Mr. W. G. Verdon Smith, the company's chairman, at the recent annual general meeting.

This . . . .

The Merchant Flying Ship

New Light on an Old Controversy by One of Our Flying Boat Designers



. . . . or this

By J. D. RENNIE, F.R.Ae.S.

MORE peaceful times are looming ahead and civil aviation is a matter of national urgency. Air transport is no longer an adventure; by its very nature it is destined to take the lead in rapid world-wide communication.

The economic speed of the merchant ship has been reached and it would seem logical, as a next step, to become airborne. This should lead to the development of the merchant flying ship operating over the long sea routes, not in competition with the surface ship but as an adjunct to it, providing a speedier service for the transport of passengers, mails, and the less bulky but more valuable specialised freight. In this country at the present time there is no indication, either from Government sources or other interests, that such a development is even under contemplation. On the contrary, it is discouraged both by the Services and the monopolistic operating company, although the latter, a large proportion of whose fleet consists of flying boats, has nevertheless publicly declared a future policy of utilising the flying boat to a limited extent only.

In recent years, both in this country and America, there has been considerable controversy on the question of "Flying Boat v. Landplane." As many of the views expressed are conflicting, biased in favour of one or the other, and often based on ignorance of the real position, the time would seem opportune, if we are not, as a nation, to "miss the boat," to discuss in some detail and in true perspective the possibilities of the merchant flying ship.

When global air transport (as distinct from trans-continental and internal) is considered, we are faced with the problem, especially over the transoceanic routes, of the choice of the most suitable type of aircraft to be used—the flying boat or the landplane? In passing, it is worth while noting that the principal industrial towns are either ports on the main transoceanic routes, or are within easy access of them and served by first-class rail and internal air services. Now, it will be realised that every form of transport has its own sphere of usefulness, competitive or otherwise; so, in deciding the type of aircraft to be used on any particular route, primary consideration should be given to first-cost, economy, safety and performance. On the other hand, if one type offers a small increase in safety over others, without sacrifice in other respects, then surely that type should be compulsorily adopted.

Another controversial point involving policy arises, namely, the size of the aircraft likely to be developed in the future for transoceanic operation. Small and large are relative terms, but for our purpose we may take about 100 tons gross weight as the dividing line; that is, small aircraft are below, and large aircraft above this weight. Now, there are two schools of thought. One favours a more frequent service of small, the other a less frequent one of large, aircraft. It would be unwise at the present state to make any prediction in this respect, but two points at least operate in favour of the large aircraft. First, from the passengers' point of view there is undoubtedly the enhanced feeling of security, a psychological effect maybe, but size does inspire confidence, and there is the extra comfort (even luxury) which can be provided.

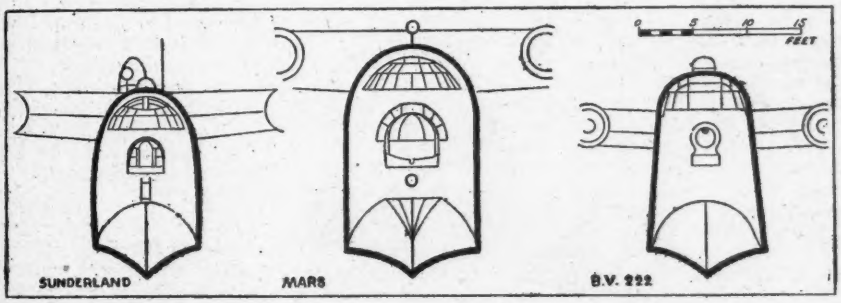
Pence per Ton/Mile

Secondly, from the operators' standpoint, an analysis shows that the trend of the direct operating costs, that is, the pence per ton-mile, decreases with size up to at least about 300 tons gross weight.

However, of this there is little doubt, that with the gas turbine-cum-jet engine, which will be available within the next ten years, aircraft of 100 tons and upwards can be built, and with human nature as it is—always aspiring to bigger and better things—such aircraft will definitely be built either in this or some other country.

It was the same with ships; the *Great Eastern* was ridiculed in her time, but, coupled with the invention of the steam turbine, paved the way for our present-day big luxury liners which, contrary to general belief, pay dividends. In a like manner, given the opportunity, we may predict with confidence, the gas turbine will give us the merchant flying ship as an outstanding contribution to aviation.

With this introduction, let us now proceed to examine the validity or otherwise of the chief arguments put forward (unfortunately with complete success so far) against proceeding with the



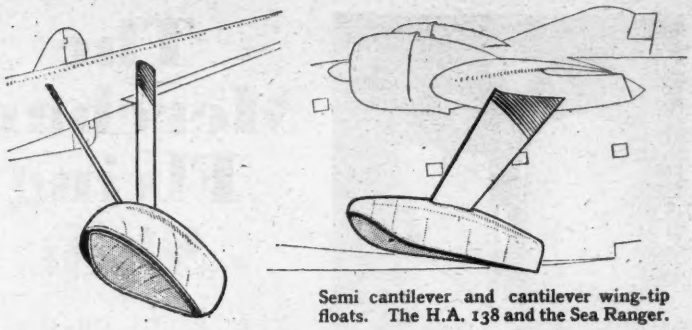
THE MERCHANT FLYING SHIP

development of the large flying boat, the "merchant flying ship."

The four main contentions are as follows:—

The flying boat is inferior in all respects to the corresponding landplane built to the same operational specification, and with equal design merit. Briefly, this means the load-carrying capacity, or the pay-load, will be less, and the cruising speed lower, hence less economical as a commercial proposition.

This is true of the small flying boat because it has to have a hull of greater depth than necessary for the required accommodation in order to obtain adequate seaworthiness, with sufficient water clearance for the propellers and tail unit. Further, the best hull form to meet the required water performance has an air drag about ten per cent. greater than the best practical streamline landplane fuselage. However, this does not necessarily mean that the efficiency is relatively so much lower that it cannot be an economic proposition under certain operational requirements.



Semi cantilever and cantilever wing-tip floats. The H.A. 138 and the Sea Ranger.

No Upper Limit

On the other hand, when the flying ship is considered, the picture changes rapidly with increase in size. Both in this country and America, estimates based on the best design data available indicate convincingly that the structure weight decreases—and hence the disposable load and the aerodynamic efficiency increases—progressively with size without predicting an upper limit in comparison with the corresponding landplane. It will be realised in this article it is possible to state only the reasons for this conviction; positive proof to satisfy the incredulous could be obtained only by building and operating the two types.

The primary design feature, not unforeseen, responsible for the above reversal in this state of affairs is found when the landing and, of course, the take-off arrangements of the two types are compared. Secondary effects, due to wing loading and hull dimensions, afford a further valuable contribution.

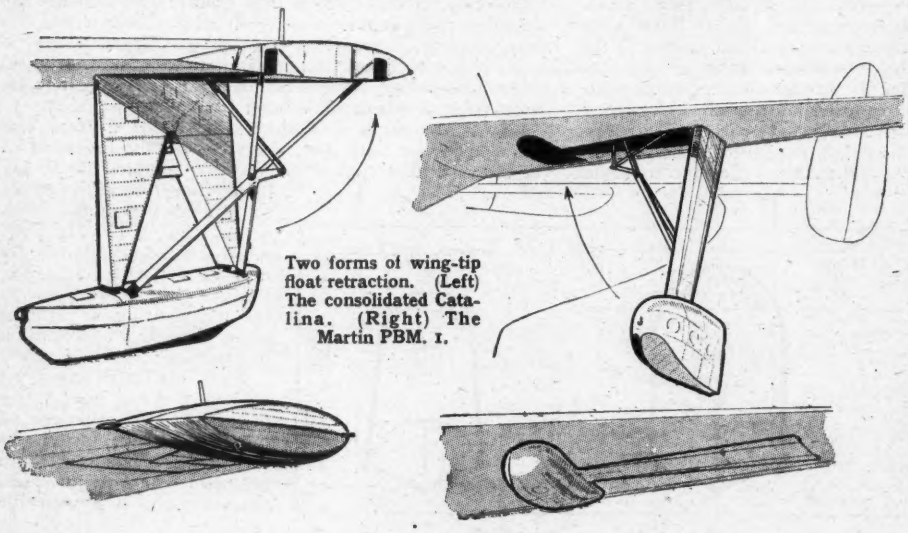
No new problems associated with the take-off and landing requirements arise with increase in size of the flying boat. Hydrodynamic efficiency, dynamic and static water stability, clean running, etc., usually denoted by the term seaworthiness, are now well defined as the result of extensive tank tests of models and full scale operational experience. Increase in size, therefore, is primarily a change in geometrical scale.

It is otherwise, however, in the case of the landplane With each successive major step in size the landing gear presents a new and difficult problem, by no means yet solved. Four, probably more, separate landing units will be necessary, all capable of withstanding direct landing loads during all, or part, of the landing run, and obviously must be retracted into either the wings or fuselage.

Provision of stowage space in the wings for the main undercart is by no means easy, as there is an aerodynamic limit to the wing thickness ratio, and engine nacelle dimensions do not increase in proportion to scale, a difficulty which would be increased further if the caterpillar track type had to be substituted for wheels. It is not suggested the problem is incapable of solution, but from the proposals so far examined it would seem likely that the additional weight and drag involved would not be found acceptable.

On the other hand, the flying ship need have only two retractable units, namely, the wing tip floats, which take no share in the main landing loads, under normal conditions, but must be capable of standing up to a rough sea. Their function is to provide, when on the water, a righting moment to counteract the inherent instability of the flying boat hull and, if present, the upsetting cross-wind rolling movement on the wing when at rest or manœuvring, during take-off and alighting, at speeds up to about 20 knots. Above that speed hydro-planing begins and, until airborne, the hydrodynamic forces acting on the hull planing bottom endow dynamic stability. Therefore, at high speeds, they are arranged to be clear of the water, and so not subjected to heavy loads, except during a forced landing in a rough sea.

Retraction into the wings is comparatively simple and has little detrimental effect on wing structure weight, as the stowage position is well outboard as against well inboard for the usual undercarriage. Further, unless the requirement is either very high speed or extreme range, retraction (apart from the complication and cost involved) may not be worth while because their low drag form will not be any greater handicap than the extra weight of retraction gear.



Two forms of wing-tip float retraction. (Left) The consolidated Catalina. (Right) The Martin PBM. 1.

Furthermore, with the introduction of the new type engine previously mentioned, and contra-rotating airscrews, adequate seaworthiness is obtainable without a proportional increase in hull depth. In both types,

therefore, the hull and fuselage may be of comparable overall dimensions, thus avoiding to a great extent the most fundamental disadvantage of the small flying boat.

Again, owing to the practicability of using higher landing-speeds or higher wing-loadings and hence a smaller wing, there is a saving in structure weight, and the wing loading may be chosen for optimum efficiency at cruising speed without sacrifice in the take-off qualities.

If we accept the above contentions, three quite reasonable deductions of prime importance may be made:—

(a) The operational efficiency, expressed in ton/miles per gallon of fuel, is higher for the flying ship than for the corresponding landplane.

(b) Landing-gear problems alone may conceivably set a much lower limit to the size of the landplane as compared with the flying ship.

(c) The prototype design and development period would be much less for the flying ship, and would warrant a more optimistic outlook on the prospects of ultimate success.

THE MERCHANT FLYING SHIP (CONTINUED)

The statement has often been repeated in authoritative military and civil aviation circles that few, if any, of the principal ports in the world are suitable for flying boat operations for the following reasons. First, there is the shipping congestion, tidal and freezing-up conditions, and inaccessibility to inland towns. Secondly, there is the inconvenience and difficulty, on the water, in the handling of passengers and freight, the carrying out of repairs, maintenance, and fuelling, all of which are practically non-existent with the airport facilities available for landplane operations.

Unfortunately this is partly true, but is due only to the neglect in the past to develop adequate sea facilities, which so far consist of a mooring and a motor launch. Even so, few experienced flying-boat pilots subscribe to these views; most of them cannot understand why something is not being done in the development of the flying ship, and its corresponding airport, considering the possibility of reliable operation, even with the primitive facilities provided, and the ability to drop in "offshore" almost anywhere in the world. Whereas it is true to say of the large transport landplane that, without an expenditure running into millions of pounds in the preparation of airfields, it could not operate at all.

Ice-bound Harbours

As for freezing-up, this occurs mainly in the North Atlantic seaboard—the Empire and South American waters are ice-free all the year round—and lasts, at the most, for only a few weeks during the winter months, during which period either an accessible alternative ice-free base may be found, or an ice-free passage opened up to clear water, in the same way as the runways on airfields in similar localities have to be continually swept clear of snow by special snowploughs.

There is really no engineering difficulty in constructing sea-airports incorporating all, and equally good, facilities as are provided in a first-class terminal airport. Further, there is a definite indication they can be built and maintained at a fraction of the cost. This claim is based on a consideration of proposed designs, and dependent on the geographical situation, either as a sheltered harbour or (if a source of water supply is available) completely landlocked.

Statistics show that in the operation of multi-engined landplanes over long stretches of open sea, the chance of a forced landing due to engine failure or other mechanical defect is negligibly small, and in any case, in the event of a forced landing, the flying boat lacks sufficient seaworthiness to guarantee a greater degree of safety. Therefore, there is no reason to use a type of aircraft, unless exceptional circumstances warrant it, which is less efficient, more costly and more difficult to operate.

This is relatively true of the wartime crossing of the North and South Atlantic oceans, in which the percentage losses have been remarkably low—a most praiseworthy achievement in organisation and aircraft reliability. On the other hand, in peacetime civil airline operation, the same percentage loss might easily be considered disturbingly high.

It will be agreed that 100 per cent. reliability in any form of transport does not exist, so it would not seem reasonable or proper to accept an additional hazard. In the interests of the security of passengers, and valuable freight, the possibility of a forced landing at sea cannot be ignored. As the size increases, other things being equal, so does the degree of seaworthiness; the flying ship will certainly mitigate the risk on all routes, although it may not entirely eliminate them. On the majority of the transoceanic routes it will, in the event of a forced landing and if unable to take off again, retain sufficient seaworthiness to make rescue a certainty under normal weather conditions. Apart from the increase with size, there is in the flying ship the additional seaworthiness due to the possibility of providing a double bottom subdivided into compartments in such a way that if any two are flooded it will remain afloat.

Cost and Insurance

The initial cost and insurance rate is higher than for the corresponding landplane.

Again, this is true of the small flying boat, first because, as previously mentioned, the hull is larger in proportion, and also because the hull bottom is of a more complicated shape to obtain the necessary water performance. Its structure, with all riveting and plating joints watertight to withstand the imposed water loads, is also more costly. Secondly, the numbers ordered are comparatively small, even in wartime, prohibiting extensive tooling-up and the adoption of mass-production methods.

Among large aircraft, of which only limited numbers will be ordered at any one time, the design and construction cost of the flying ship, assuming equally efficient management and plant, is bound to be considerably the lower. This is due not only to the manufacturing cost, machining and assembly of the undercarriages of landplanes but of the cutaways in the wing structure for their retraction. In other words it would appear that the cost of the hull and wing tip floats would be about offset by the fuselage and wing cutaways, leaving that of the undercarriages to the credit side.

The reason given for the higher insurance risk rate is that in the event of extensive damage to the hull bottom, unless promptly beached (not usually possible) the aircraft may sink, and even if salvaged become a complete write-off. Whereas, when the landplane is damaged, the geographical position and the condition are generally such that repairs are worthwhile, and may be carried out either on the spot or at the repair base.

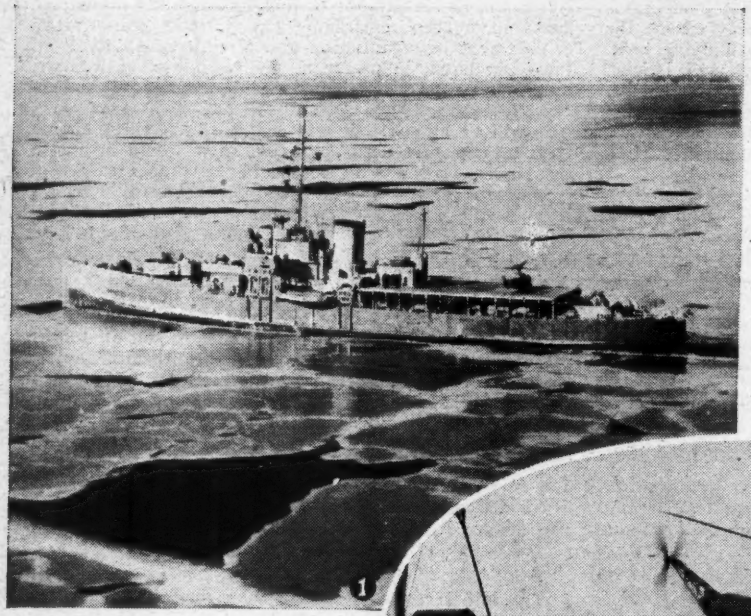
However, the liability of the flying ship becoming a total loss due to extensive hull damage when provided with a double bottom and its own airport should be a rare occurrence. Whereas the large landplane, due either to a forced landing on an unprepared airfield (for reasons common to both types), or in the event of a burst tyre or undercarriage failure, may easily be much more extensively damaged, and beyond salvage. Under these circumstances, therefore, it would seem reasonable to suppose the insurance rate would cease to have any real significance.

It is hoped this discussion on the merits and demerits of the flying ship have been found informative, and have helped to stimulate interest in this not so familiar and much-neglected type of aircraft. It has presented a sound case for at least proceeding with the development of the flying ship and its airport, an opportunity offered to the large landplane on the recommendation of the Brabazon Committee without reference to the claims of the flying boat or suggestion as to its future possibilities.

D

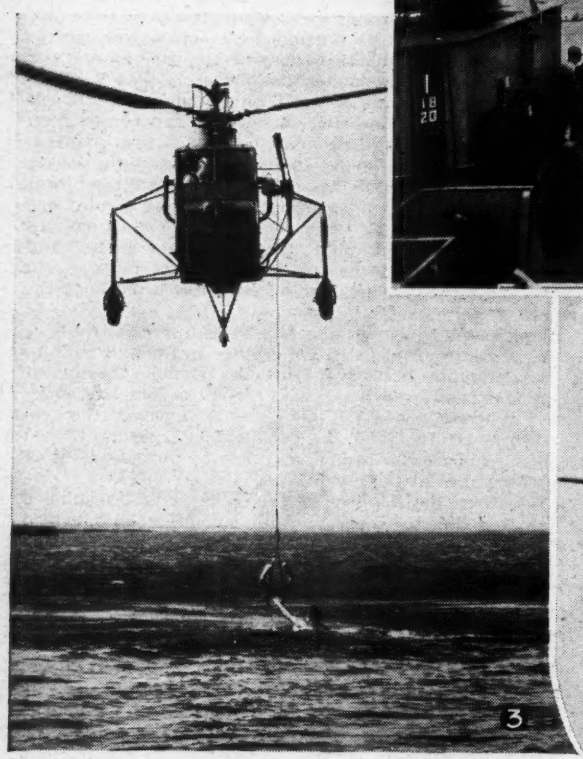
Helicop
Rescue a

Photographs of Air/Sea Res
Description of a Flight



1. A U.S. Coastguard cutter noses its way through the loose ice off the Atlantic coast. The helicopter is revving-up its rotor on the tiny flight deck.

2. Using what must be the smaliest flight deck ever, a Sikorsky takes-off vertically to go on an air/sea rescue sortie.



3. Having made contact with the victim, a special U-type harness is lowered from a small crane on the port side of the aircraft. 4. Finally the "rescuee" is hoisted on board.

...pters for ...al Training

...a Res...ork by U.S. Coastguards : ...light ... R.A.F. Training Sikorsky

A formation of four Sikorsky R-4s of the Royal Air Force helicopter school. If R.A.F. displays ever become the fashion again, some effective and exciting flying should be possible.

THAT the Royal Air Force possesses a certain number ot rotating-wing aircraft is generally known, and in some parts of the country they are a fairly familiar sight. The average observer is probably not able to distinguish between an autogiro and a helicopter, at least when both are seen in flight from a distance. The fact that the former is being pulled along by an orthodox airscrew with its rotor "windmilling" under the air forces on it, while the latter has its rotor driven by the engine direct, is not readily discernible.

So far as flying controls are concerned, the autogiro may be regarded as a halfway-house between ordinary fixed-wing aircraft and the helicopter. It is guided by a control stick, a rudder bar and the engine throttle. That comparative control simplicity has not yet been achieved in the helicopter, although it would seem to be attainable with further development. Consequently, a specialised helicopter flying school is essential if we are to have pilots experienced in handling the flow of helicopter aircraft which may be expected to swell the flying equipment of our Services during the next few years.

A small beginning has been made with the establishment of the helicopter flying school at Andover, which is in the charge of Sqn. Ldr. B. H. Arkell. At the moment the school caters for ten pupils at a time, but when more machines become available doubtless the number will be increased. Pupils for the school are drawn partly from the Royal Air Force and partly from the Army. All are pilots of fixed-wing aircraft and the course is thus in the nature of a conversion course

WANT A LIFT? Stepping aboard an R-4 hovering just above the ground.

Judging from the number of letters we receive from readers who look upon the helicopter as being already the aircraft for the "man in the street," there is a fairly widespread impression that flying a helicopter is very easy. After all, the machine "goes straight up and comes straight down"; consequently there is no need for that nice judgment of the approach which is essential in fixed-wing aircraft. While that is partly true, it is far from being the whole story, as will be appreciated from the fact that the average period of dual control needed before a pilot is considered fit to go solo is between five and ten hours. Even then, many more hours' flying are necessary before the pilot is regarded as really proficient. Present experience indicates a tuition period of from 20 to 30 hours before a fixed-wing pilot can be expected to handle the helicopter really well. So far there is little accumulated experience of the time that would be taken for a complete *ab initio* course, but Sqn. Ldr. Arkell considers it likely that it would be about the same as for fixed-wing aircraft. As he points out, whatever the type of aircraft, the pupil must have instilled into him that air sense without which no one can be considered a safe pilot.

Power Plant

The type of helicopter used at the Andover helicopter school is the Sikorsky R-4. This is a side-by-side two-seater, powered by a 185 h.p. Warner Superscarab engine. Mounted as it is inside the fuselage, behind the pilots, the engine is cooled by a fan placed behind it, but between it and the gear box of the rotor transmission. The engine cylinders are baffled to direct the air current, and the gear box derives sufficient cooling from the air sucked across it by the fan. After passing over the engine the cooling air flows out through an opening in the bottom of the fuselage, and partly through openings in the sides. The cooling-air intake is in the roof, a position in which it is in the downdraught from the rotor. Since the engine is mounted in the usual way, a right-angle drive is used. Doubtless in the future we shall have engines with their crankshafts vertical, although reduction gearing will still be necessary in view of the fact that the rotor (in this particular model) runs at only some 200 r.p.m. Transmission to the anti-torque rotor on the stern is by a long shaft provided with a universal near the tail, where there is a considerable angle in the shaft.

Flying control of rotating wings may be said to be based upon two

HELICOPTERS FOR RESCUE AND TRAINING (CONTD.)

main systems; that in which the whole rotor head is tilted to change the direction of the lift, and that in which individual blades have their angle of incidence changed on their way around the circle. The former system is used in the Cierva Autogiros. The cyclic pitch change, as it is called, is employed in the Sikorsky R-4. A complication arises from the fact that in a helicopter using this system not only is a cyclic pitch change necessary but also one which will alter the angle of incidence of all the blades simultaneously.

The need for this will be obvious from a brief consideration of what happens when a rotating-wing aircraft is controlled. With a tilting rotor head the plane of rotation of the rotor is tilted. For climbing, for instance; the pilot pulls back the stick as he would in an orthodox aircraft. The rotor tilts back and its line of lift is inclined backwards, raising the nose. With a cyclic pitch change this is possible only to a minor extent (such as for maintaining the aircraft level in normal cruising flight). Climb and descent in the Sikorsky R-4 are controlled by changing the incidence of all the blades simultaneously, keeping the aircraft on a more or less even keel.

At normal cruising speed the rotor is driven at approximately 210 r.p.m. For climbing, the blade angle is increased, and for descending it is decreased. But obviously the greater angle of incidence causes greater drag and hence needs greater power to overcome this drag. Consequently the throttle must be opened if the blades are not to slow down. It is one of the peculiarities of rotary-wing aircraft that whatever the forward speed of the machine, the rotor speed must be kept fairly constant, hence the need for a close watch on its rev indicator.

In the Sikorsky R-4 the lever which controls the pitch of all the blades is interconnected with the engine throttle, but since the relationship between rotor pitch and throttle is not constant for all conditions that are encountered, a twist grip is mounted on the end of this lever. This twist grip may in a way be regarded as a form of vernier adjustment. It can be used for speeding up the rotor at a smaller incidence than that catered for by the normal setting, thus getting extra lift from increased rotor speed rather than from an increased angle of incidence. But rotor speed should never be varied to any great extent.

Autorotation

Apart from the question of normal take-off, climb, flight, descent and landing, the case of engine failure has to be taken care of. At cruising speed the angle of the blades is some 9-10 deg. To ensure autorotation it must be about 2½ deg. Thus if the engine stops suddenly the pilot must instantly reduce the angle to that figure by the pitch lever. This action doubtless could be made automatic, but in the R-4, which is to be regarded as a fairly primitive trainer type, the pilot must remember to do it, and at once.

The flying controls of the Sikorsky are three in number: the lever which controls the pitch of the blades cyclically, called the "azimuth lever," the main combined pitch and throttle lever, and the "rudder" pedals. Most of our readers will already know, from previous articles in *Flight*, that instead of the orthodox rudder there is a small airscrew or rotor placed "edge-on" to the line of flight. Directional control of the aircraft is effected by changing the pitch of the blades, thus increasing or decreasing the thrust of the airscrew which is, of course, at right angles to the line of flight. This change of pitch is effected via pedals in the cockpit. Here it might be mentioned that the blades of the tail rotor are mounted on hinges which allow them to "flap" slightly, the movement being restricted by rubber-padded stops. This freedom to flap is necessitated by the "edge-on" nature of the airflow over the blades. The blade which is "advancing" is obviously in an airflow of greater velocity than that met by a blade which is "retreating," and is therefore giving greater thrust. If it were not able to relieve itself by flapping it would be bent unless the blade were unnecessarily strong and heavy. The flapping is automatic.

Returning to the cockpit, the "azimuth levers" (there are two for dual control) are vertical and placed on the outside. The main pitch control lever is in the centre, between the two seats, so that it can be operated from either. For fine pitch, such as for autorotation, it lies almost horizontal, and for coarse pitch it is raised. At the same time the twist grip is turned in the appropriate direction. It must be admitted that the combined movements of the two levers, augmented by small deflections of the tail-rotor pedals, call for a dexterity rather akin to that of patting one's head and rubbing one's chest at the same time. Fortunately the main pitch lever is not in constant use during flight, but in take-offs and landings its task becomes absolutely paramount.

Pitch Change

In normal flight all controlling is done with the "azimuth lever." The cyclic pitch change has the same effect as the elevator and ailerons in an orthodox fixed-wing aircraft. The movement is very slight, and from the pupil's seat one has to watch the instructor very carefully to detect it. Pushing the stick forward causes the nose to drop and the machine starts to move forward. Pulling it back makes the machine travel backwards (rudder control in that case has, of course, to be reversed). Movement to one side causes a bank, which can either be made into a turn by using the rudder control, or it can, by the same agency, cause the aircraft to travel sideways. These manœuvres have to be matched by manipulation of the main pitch and throttle lever, since slightly greater power is needed when the aircraft diverges from its straight flight path. We have not seen it done, but we are assured that a 90-deg. bank is quite possible with the R-4. On the other hand, a flat turn means nothing in the young life of this machine.

Perhaps the simplest way of visualising the functions of the two main levers is to remember that the azimuth lever controls the direction of the lifting force, and the pitch lever its magnitude. There are two more levers to worry the would-be helicopter pilot, but they are not in use during flight. One controls the clutch in the rotor transmission and the other the wheel brakes.

One's first flight in a helicopter is an experience worth having. The vertical ascent is not, somehow, surprising. One expects it. But then comes the forward tilt, which one expects from fixed-wing aircraft experience to result in a dive into the ground. It does nothing of the sort; the machine merely begins to travel forward. There is an obstruction ahead, but instead of the nose pointing upwards to clear it, the machine crabs sideways and avoids it without changing altitude. One feels, although the feeling is somewhat illusory, that if the pupil is in any doubt, he has plenty of time to get out the instruction book to find out what is the proper thing to do next.

A few figures relating to the Sikorsky R-4 may be of interest. The rotor has a diameter of 38ft., and as the cruising revs are 210 r.p.m. the tip speed is about 285 m.p.h. at zero forward speed. The cruising speed is in the neighbourhood of 70 m.p.h. and the ceiling about 10,000ft. With instructor, pupil and fuel for two hours' cruising the loaded weight is 2,050 lb. In autorotation the rate of descent is some 1,200 ft./min. (20 ft./sec.), which is too fast for a safe landing unless the pilot can, by increasing pitch at the last moment and using the flywheel energy in the rotor to keep its speed for a few seconds, check the rate of descent just before touching-down. The fuselage is a steel tube structure, and the main rotor blades have tubular spars, spruce ribs, balsa wood leading-edge sheathed with metal, and fabric covering. The blades have both drag hinges and flapping hinges, as in the autogiro.

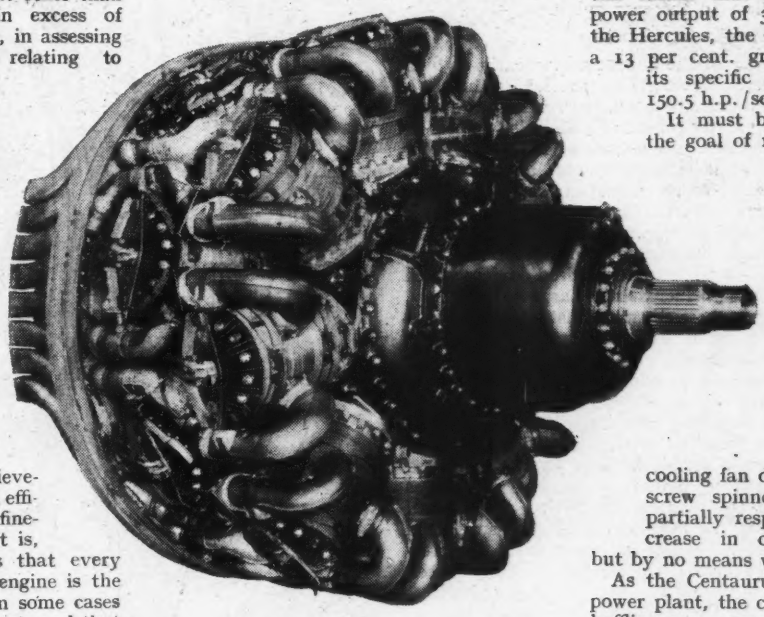
Bristol Centaurus

Survey of Britain's Most Powerful Radial Engine : An Example of Logical Layout to Achieve Compactness with Power

IT has been common knowledge for some time past that the Bristol Aeroplane Co., Ltd., have been engaged with the production of a larger and improved model in the range of radial, air-cooled, sleeve-valve engines with which they have for so long enhanced their reputation. This common knowledge—the result of unofficial "leaks"—embraced the facts that the new engine was an 18-cylinder unit of over 2,000 h.p. and was called the Centaurus. Other than this nothing much was generally known until sanctioned reference to the engine was made with the release of the Short Shetland flying boat (*Flight*, May 17th, 1945), when it was revealed that the Centaurus was of over 2,500 h.p.

Even now we are not permitted to give any indication of the power output other than that it is well in excess of 2,500 h.p., so that, in assessing specific qualities relating to power, one can only use the figure of 2,500 as a datum and state that the equated result is somewhat lower than the factual value.

Probably the most impressive feature to strike the casual observer of the Centaurus is the compactness of the unit in relation to its power output, and, as a corollary, the achievement of a clean and efficient fairing by refinement of design. It is, of course, obvious that every component in the engine is the result of months, in some cases years, of development, and that the only means by which such workmanship can bear fruit is by way of the hard road of technical ability followed strongly by the incessant trial and error of testing. By such means a tremendous fund of data is amassed, such data being the "history" only through which the future may be discerned. Looking back in order to look forward applies equally in the technical as in the ordinary world.



Compactness without complication. Note the backswept exhaust stack cooling muffs and the collected exhaust tail pipes.

Specific Powers

From the aspect of arrangement analysis the Centaurus is basically similar to its immediate forerunner, the Hercules, with the chief differences that it has four more cylinders and that entirely separate individual gear trains are embodied front and rear for driving the sleeves in the respective cylinder banks. Swept volume is naturally larger, but so is the unit swept volume as, although the cylinder bores remain the same at 5.75in., the stroke of the Centaurus is 7.0in. as compared with the 6.5in. of the Hercules. This gives the new engine a capacity of 53.6 litres (3,270 cu. in.) in contrast to the Hercules' 38.7 litres (2,360 cu. in.), an increment of 38.5 per cent. In terms of capacity and power output, at the restricted Centaurus power figure of 2,500, the b.h.p./litre of both Hercules and Centaurus is 46.5, although we know that the latter engine is somewhat better than this, as may be roughly indicated by the figures for b.h.p./sq. in. of piston area, these being respectively: Hercules 4.93, and Centaurus better than 5.34.

Cooling Arrangements

As an indication of refinement in the design of the cowling, if we take as a datum the frontal area of the Hercules at 2,122 sq. in. and give it the value of unity, then the Centaurus frontal area of 2,402 sq. in. gives a comparative ratio of 1.13:1, which is well below the relative h.p. ratio of 1.385:1, itself a conservative figure. Put another way, this means that for an increase in power output of 38.5 per cent. over the Hercules, the Centaurus has only a 13 per cent. greater frontal area, its specific power thus being 150.5 h.p./sq. ft.

It must be appreciated that the goal of really close cowling is hindered in attainment by the very critical factors of cooling, and Bristol's achievement is rendered the more deserving of praise by virtue of their having obtained, with it, an enhanced cooling efficiency. To a certain extent the employment of a cooling fan driven from the airscrew spinner can be deemed partially responsible for the increase in cooling efficiency—but by no means wholly.

As the Centaurus is designed as a power plant, the cowling, fairing and baffling arrangements naturally come into the picture in addition to the engine *per se*, so whilst on the subject of cowling we might as well deal with it before going on to the engine proper. The subject is well worthy of study.

The main body of the engine in way of the cylinder banks is closely cowled by four panels, two per side, hinged together at top and bottom on the fore and aft centre plane of the engine and secured together with three toggle-type fasteners on each side. The latter are recessed to give a smooth surface line. Forward of the cowling panels is the aerofoil-section annular nose fairing which, with the very unusual spinner extension fairing (fitted around the reduction gear casing), provides a smoothly contoured, but surprisingly small, annular intake duct in the entry of which rotates the 18-blade cooling fan fitted to the rear of the spinner.

It may thus be seen that cooling air entrained is obstructed not at all until it reaches the front cylinders. Having done its due amount of fin circulation the air is then allowed to escape to the outside atmosphere through cooling gills in the skirt ring of the main cowling panels. In consideration of the amount of development design which has gone into producing the Centaurus, the instance

BRISTOL CENTAURUS

of cylinder and head finning is interesting. By experiment it has been shown that the optimum pitch for fin location is in the region of 0.11in.—the pitch on the Centaurus is 0.12in. and the cooling area of finning to each cylinder and head is no less than 32.47 sq. ft.

Not the least novel feature of the cooling arrangements is the fact that, unexpectedly enough, the front row of cylinders, due to the amazing control of the cooling airflow, actually runs a trifle hotter than the rear row. Pressure drop in the cooling air through, or, rather, across the cylinders is the rather high figure of 10 inches of water, and, very shrewdly, this is put to incidental, yet none the less useful, advantage in cooling the rear-swept front-cylinder exhaust pipes. These are shrouded with tubular muffs, open at each end, which extend nearly to the transverse centre plane of the engine, and the pressure differential between front and rear open ends induces an airflow through the muffs which effectively cools the exhaust pipes whilst, at the same time, isolating their cooling air from the ordinary flow to the rear cylinders.

Limits of Cooling

The cooling efficiency of the Centaurus is nearly as high as it is possible to get. There are for the future the additional refinements of a geared cooling fan running at higher speed so inducting a greater mass flow, and also the closer pitching of the cooling fins. Nevertheless, it would appear that the ultimate is at least within sight, and from this aspect it is a reasonable assumption that some limit will sooner or later enforce a barrier against the use of more potent fuels and increase of engine rating by stepping up the b.m.e.p. This reflection excludes consideration of the use of water/methanol injection and kindred devices which conceivably might have an increasingly large part to play.

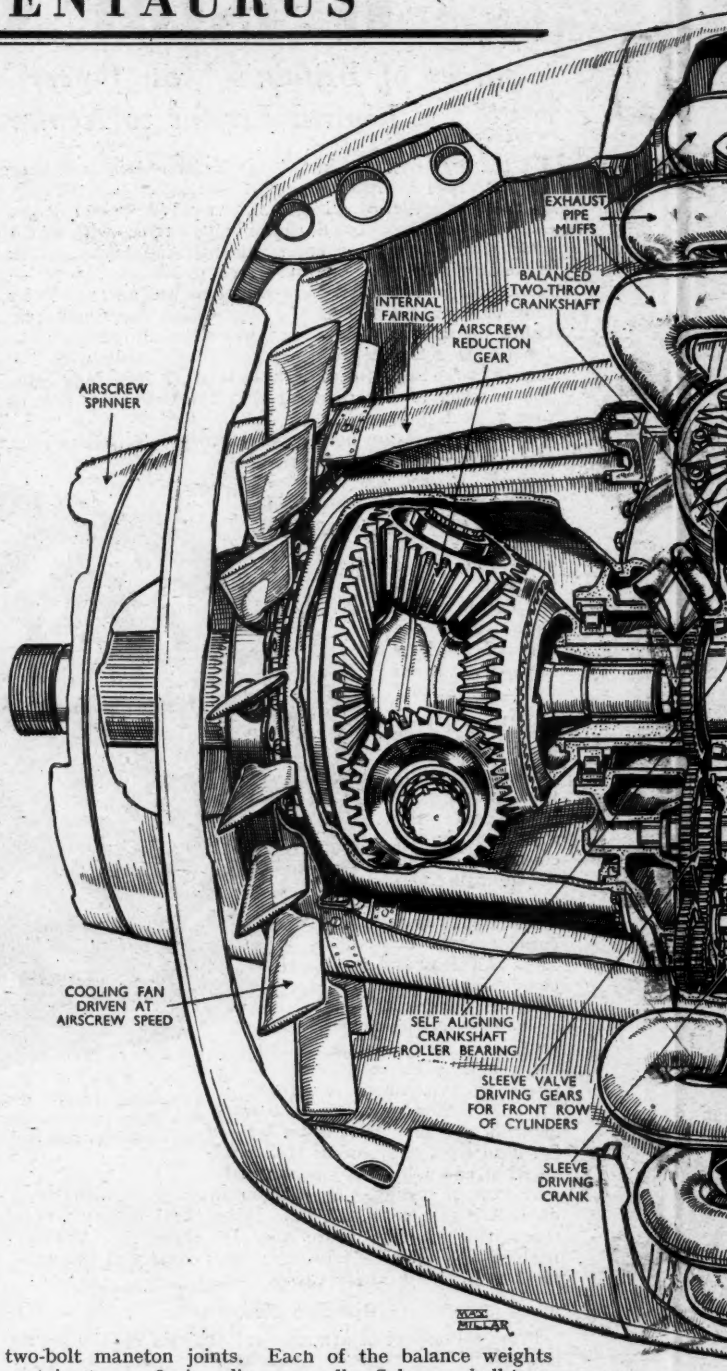
The reduction gear is the well-tried Bristol-Farman type bevel epicyclic which is so well known as to render a further description superfluous. One element is, however, worthy of note; the rear driving bevel and the front stationary (sun) bevel ring are both located on annular seatings, the bearing faces of which are spherically curved. This measure ensures that the driving and sun bevels can each rock slightly and so permit the load to be distributed equally among all three planet pinnions. The three "spokes" on which the planets are carried are integral with the airscrew shaft, the tailpiece of which is supported in a bearing in the forward end of the crankshaft. Airscrew thrust is carried by a large-diameter ball-bearing housed in the front of the r.g. casing forward of the gear itself.

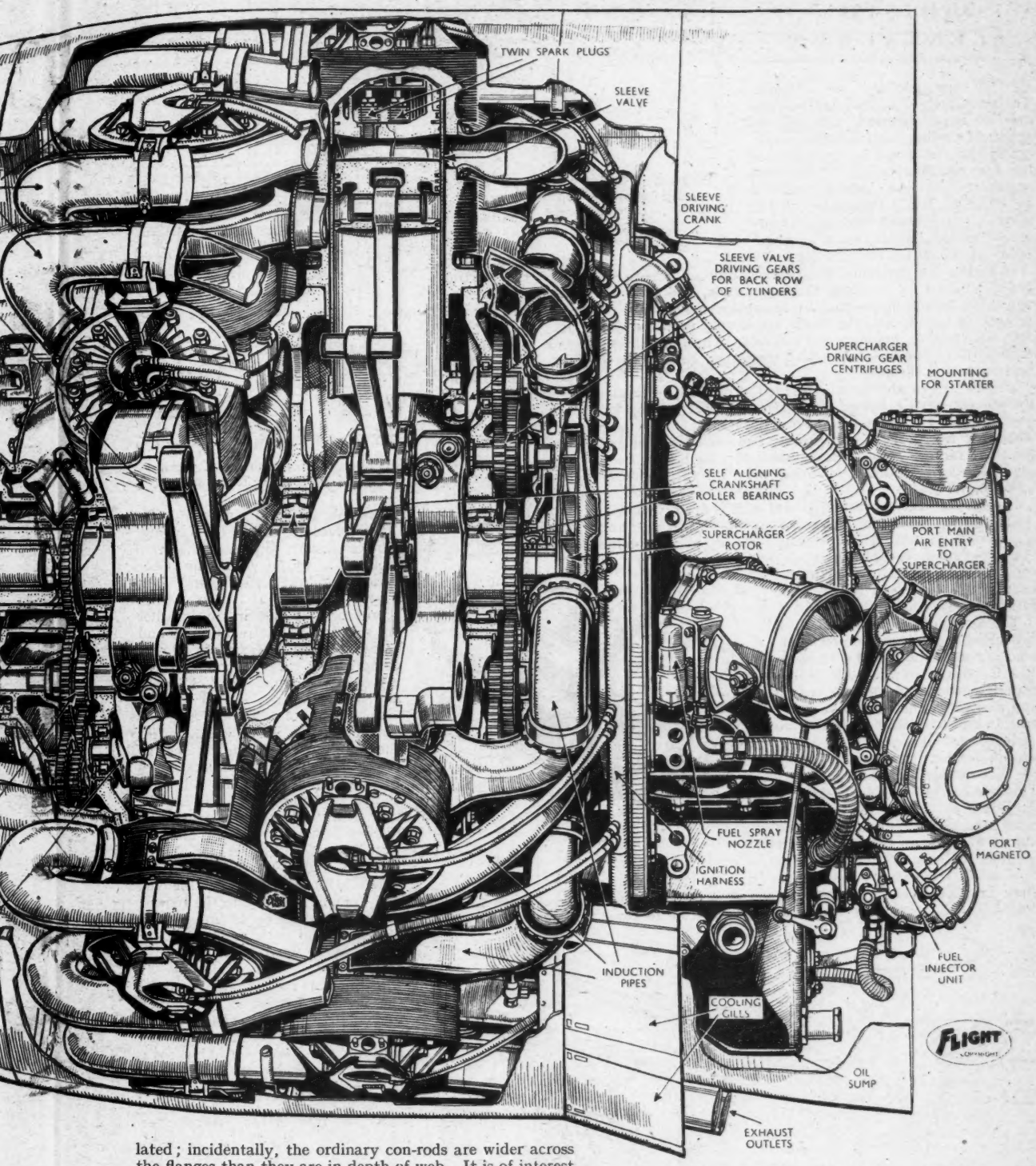
The crankcase of the Centaurus is unorthodox in that it is composed of three sections—front, centre, and rear—the mating faces of which are disposed on the transverse centre planes of the cylinder banks. Each section has a diaphragm, those of the front and rear supporting the sleeve drive bearings and isolating the gear trains from the crank throws, and that of the centre provides a support for the main central crankshaft bearing. The front and rear sections of the casing are secured to the central section by hollow bolts on each side of each cylinder. Mating faces are metal-to-metal, there being no gaskets, this in itself being a tribute to the Bristol production efficiency.

Both sets of sleeve drives are composed of spur gear trains powered from a common input gear mounted on the crankshaft. A description of one set suffices for both, as front and rear drives are identical. Meshing with the central input gear are three equispaced intermediate gears each of which drives the middle wheel of a separate train of three, each of the three wheels driving a sleeve crank; the three sleeve-driving wheels are connected in a train by idler wheels, one between adjacent pairs.

A built-up, nitrided crankshaft—also in three sections—is employed, the front and rear sections, which include the balance weights, being attached to the central section by two-bolt maneton joints. Each of the balance weights contain two 2.875in. dia., 3.52 lb. Saloman ball-type vibration absorbers which have proved to be very effective in de-tuning both torsional and flexural vibration. Examination of the double curvature seat track of the ball enclosures has established that the ball movement either longitudinally or transversely does not exceed 0.75in.

Big-end bearings carry-on the unique Bristol precedent of employing white-metalled sleeves shrunk on to the crankpins, in contrast to the more usual floating-bush type bearing. Each crankpin carries a master connecting rod to which the other eight very slim con-rods are articu-





lated; incidentally, the ordinary con-rods are wider across the flanges than they are in depth of web. It is of interest to note that the master-rod big-end bearing is of 12.05 sq. in. projected area, whilst the wrist-pin bearing area of the normal rods is 1.583 sq. in., as against a little-end area of 1.575 sq. in. Oil ducts in the crankshaft lubricate the main and big-end bearings and also feed jets in the balance weights which spray the pistons, sleeves and little-ends; wrist-pins are lubricated from the big-end supply

This special *Flight* drawing by Max Miliar lays bare the arrangement and structural details of the Centaurus. Careful profiling of the cooling air intake entry is a noteworthy feature of the design. The sectioned cylinder at the top of the drawing clearly shows the relative dispesition of piston and rod assembly with cylinder, sleeve, head and porting

BRISTOL CENTAURUS

through spring-loaded oil retainers. The three high-capacity main bearings are of large diameter and of the spherical roller, self-aligning type, crankshaft end thrust being restrained by the central bearing. Maximum angularity of the master rods is 13 deg. 38 min., but some of the normal rods (which are not evenly spaced on the master) reach an angularity of something over 20 deg.

Cylinders are machined from forged billets, each barrel being retained by 16 large-diameter studs, the nuts for which are locked in position by spring locking plates. As previously mentioned, the heads are deeply indented and are, additionally, made in two sections. The top half is a casting (including fins) into which the forged and machined bottom half is shrunk.

Sleeves are of the latest stiffened type and as master rod sleeves have a harder time than the others, they are shell pressed, in contrast to normal sleeves, which are cast. There are five ports in each sleeve, two each for inlet and exhaust, and one which is a common port for both. Porting areas are respectively: inlet, 6.65 sq. in., exhaust, 4.00 sq. in.

Pistons are very short-skirted and each is fitted with two wedge-section gas rings, a channel-section scraper ring and a normal type bottom scraper ring. Projected area of the gudgeon pin in the piston is 3.23 sq. in. and, as the rod little-end bearing area is 1.575 sq. in., the ratio is 0.487 : 1.

The Centaurus is aspirated by a two-speed, single-stage blower operated in conjunction with a Hobson-R.A.E. fuel injector. Air is entrained on both sides of the engine and ducted to the respective main entries on each side of the drive casing, where it is fed into a beautifully formed turbine-type entry to the double-shrouded impeller. This discharges through a diffuser vane ring to the several induction pipes serving the cylinders. All the induction pipes are the same length in order to ensure equal distribution, and terminate in cast light-alloy branch yokes which are bolted to the cylinders and distribute the charge over the porting areas.

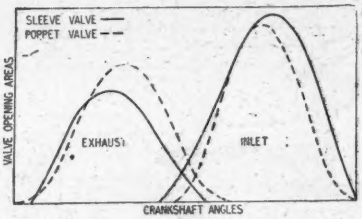
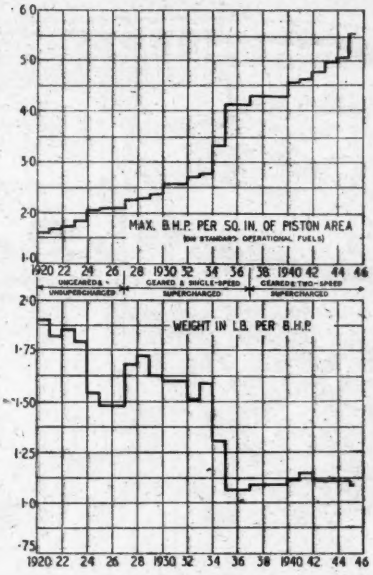
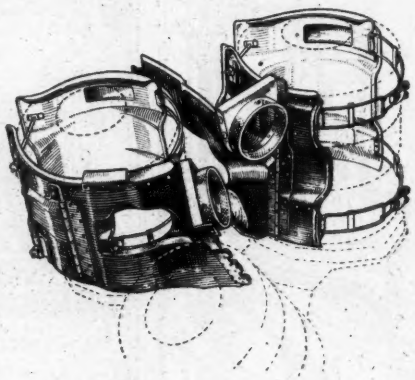


Diagram of sleeve and poppet valve overlap showing opening against crank angle.


MAX. B.H.P. PER SQ. IN. OF PISTON AREA
(ON STANDARD OPERATIONAL FUELS)
UNGEARED & UNSUPERCHARGED
GEARED & SINGLE-SPEED SUPERCHARGED
GEARED & TWO-SPEED SUPERCHARGED
WEIGHT IN LB. PER B.H.P.
1920 22 24 26 28 1930 32 34 36 38 1940 42 44 46

Bristol engine development of specific power and specific weight against year.

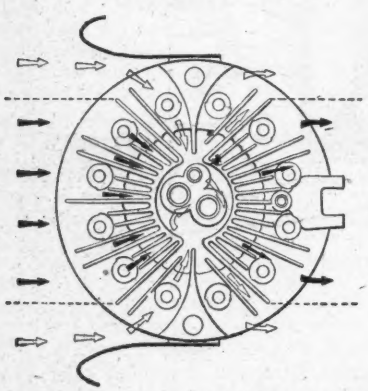
Blower drive for "M" or "S" gear is by means of two compound hydraulic clutches, oil for which passes through two centrifuges which remove all sludge and deleterious matter. Both are mounted above the clutches and are readily accessible for cleaning. The clutches themselves are driven by a spring-drive gear on the tail of the crankshaft to protect the drive from cyclic torque variations. Gear ratios are: low, 6.761 : 1, and high, 9.03 : 1, which, at 2,700 r.p.m. (crankshaft) result in an impeller tip speed of respectively 1,012 and 1,325 feet/sec. Maximum blower compression ratio is achieved at 2,700 engine r.p.m. in "S" gear and equals 3.5 : 1.

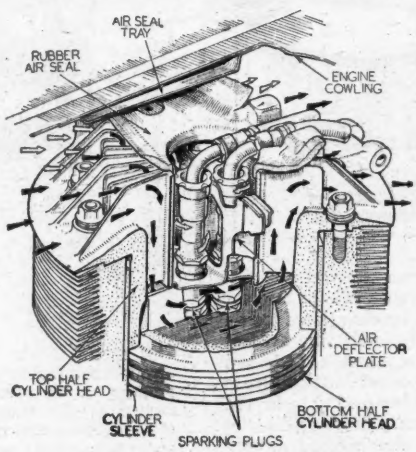


Cylinder baffles, by means of which the air is directed to cover the optimum fin area.

Selection of blower gear is governed by a valve which varies the supply of oil to the clutches as required, and the valve determines the gear according to the induction charge requirements of the engine, this being linked up with the Hobson-R.A.E. injector. This injector was developed by Farnborough and is manufactured by Claudel Hobson. It meters the correct amount of fuel into the blower entry according to an integration of blower and back pressure differential with charge temperature existing for a given engine speed. The injector nozzles are fitted in the twin air entries to the blower immediately "down-stream" of the butterfly throttles. Mixture ratio for full power is roughly 10 : 1 by weight, and for economic cruising conditions approximately 16 : 1 by weight.

At the rear of the supercharger drive shaft is a gear box containing the drives for the supercharger itself and the various engine accessories, such as fuel and oil pumps, magnetos, tachometer, engine starter, etc. The twin magnetos which, externally, look strangely like little centrifugal blowers, are mounted on raking faces to port and starboard of





These two details show the disposal of head finning and the cooling air flow paths.

BRISTOL CENTAURUS

the forementioned gear box, whilst the engine starter is mounted vertically above it and engages through a dogged coupling.

The following major items on the Centaurus are supplied by the undermentioned firms:—

Magnetos	British Thomson-Houston.
Ignition Harness	Plessey or Marconi.
Sparking Plugs	Lodge.
Flexible Pipes	Superflexit or Avery.
Pistons	Material: High Duty Alloys. Machining: Wellworthy or Bristol.
Piston Rings	Brico, Wellworthy, or Hepworth and Grandage.
Injector	Hobson.

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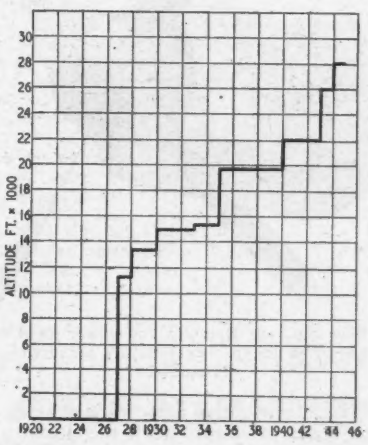
Type	18-cylinder, two-row radial, air-cooled, sleeve-valve, with two-speed supercharger and Hobson-R.A.E. injector.
Bore and stroke	5.75 in. x 7.0 in.
Compression ratio	7.2 : 1.
Swept volume	3,270 cu. in. (53.6 litres).
Diameter over cylinders	55.3 in.
Airscrew reduction gear ratio	0.444 engine speed.
Airscrew rotation	L.H. tractor.
Airscrew shaft size	S.B.A.C. standard No. 6.
Fuel specification	D.E.D. 2475 (100/130 grade).
Oil specification	D.E.D. 2472.
Oil consumption (average)	2.5 g.p.h. at 2,400 r.p.m.; 1.12 g.p.h. at 1,600 r.p.m.
Engine weight (bare, dry)	2,780 lb.
Firing order	1, 12, 5, 16, 9, 2, 13, 6, 17, 10, 3, 14, 7, 18, 11, 4, 15, 8.

Bristol Review

Something of Past Effort and Future Intentions Together with Announcements of New Engines and Aircraft

COMPARABLY with most other major concerns, all of which go to make the British aircraft industry, only a small proportion of the work the Bristol Aeroplane Co., Ltd., have been engaged upon during the past six years has come to light. However, as a result of an exhibition staged at Bristol on June 28th, we are now in a position to give a fairly wide survey of the company's activities.

In the preceding pages will be found a description of the latest and most powerful Bristol engine, the Centaurus; but, in addition to the new engine, three new models of the well-tried Hercules are also announced, these being designated respectively Mk. 100, 120 and 130. All, of course, are basically similar, the chief differences lying in the superchargers. The Mark 100 is the latest military Hercules, and has the highest maximum power output of the three at 1,800 b.h.p. It employs a two-speed supercharger of improved entry shape and impeller design together with a Hobson-R.A.E. fuel injector. Mark 120 Hercules also have the new two-speed blower and Hobson-R.A.E. injector, but operate at slightly reduced ratings, these engines having been produced primarily for high-altitude civil aircraft, for which employment they are fitted with a special rear cover having an increased capacity accessory drive capable of transmitting up to 150 h.p. to cope with the cabin blowers necessary for pressurising. The Hercules 130 is actually the 10M model described in the May 24th issue of *Flight*, and is fitted only with a single-speed supercharger, being designed for economic operation at moderate altitudes.



Increase in altitude at which successive engines have maintained boost equivalent to Jupiter at full throttle, sea level.

Whilst on the subject of aircraft power units it is appropriate to reveal that Bristols have been interested for some time in the various forms of gas turbines, and, in fact, they carried out trials on the exhaust-driven turbo-supercharger as early as 1923 and 1924. Theoretical studies were continued, and were given additional impetus by the success of Air Commodore Whittle's brilliant pioneer work on jet-propulsion. It was felt that the field indicated by their previous experience lay in the larger and longer-range aircraft, and their design work, which was directed towards the provision of a gas-turbine for these types, was concentrated along specific lines early in 1941. This has culminated in the production of a gas-turbine in which the bulk of the power is utilised to drive a variable-pitch airscrew of normal type; means have also been provided in the design for the recuperation of heat energy, which would otherwise be lost in the jet discharge.

That the power for many types of both civil and military aircraft of the future will be provided by jet propulsion or the gas turbine is certain. There is, however, much development to be done before the gas turbine can, for instance, be an economical proposition for airline operation, and it is, therefore, prudent to assume that the reciprocating engine still has years of useful life before it.

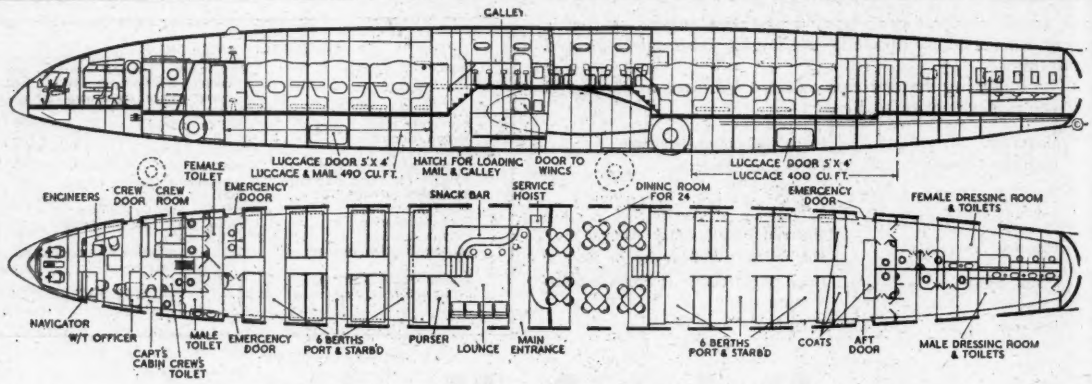
The preference of airline operators for radial engines in the larger classes of civil transports was fairly marked before the war, and it would appear that this preference still stands. The list of new aircraft powered by Bristol is impressive:—

Centaurus, 18-cylinders, "over 2,500 b.h.p."
- Short Shetland flying boat.
- Airspeed A.S.57 airliner.
- Bristol Type 167 (Brabazon I) airliner

Hercules, 14-cylinders 1,675/1,800 b.h.p.
- Short Sunderland flying boat.
- Handley Page Hermes airliner.
- Handley Page Hermes transport.
- Handley Page Halifax transport.
- Vickers-Armstrong Viking airliner.
- Bristol Freighter.
- Bristol Wayfarer aircoach.

One of the merits of the Bristol engine is that the original design was generous in conception with precisely the need for increasing powers in mind. The Hercules, for instance, has been increased from 1,375 b.h.p. in 1937 to 1,800 b.h.p. to-day, a gain in power of over 30 per cent., which has been obtained at the expense of only about 10 per cent. increase in engine weight. Both Hercules and Centaurus are certainly capable of development to still higher outputs, and may confidently be expected to cover the 2,000-3,000 b.h.p. range in the near future. Below this range it is probable that Bristol will also offer a development of the Perseus nine-cylinder sleeve-valve engine with a power of around 1,200 b.p.h. compared with the pre-war

BRISTOL REVIEW

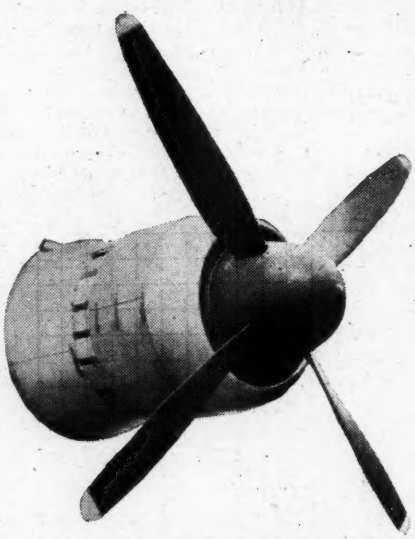


An accommodation arrangement for the 110-ton Brabazon I. This particular layout is devised for the day and night transportation of 72 passengers; each of the port and starboard compartments seating six—three side by side facing fore and aft—and also sleeping six. The seats are converted to lower and upper berths with the addition of permanent topmast berths. A short-stage version caters for a maximum of 224 passengers. Spacious crew accommodation is provided, whilst the mid-ship layout of the upper deck includes a dining room, lounge and snack bar. The aircraft is designed for a still-air range of 5,000 miles at an economical cruising speed of 250 m.p.h. at 25,000ft. For the latter operation the whole accommodation is pressurised for a differential of 5½ lb./sq. in.

version, which developed rather less than 1,000 h.p.

All these engines are available in the form of complete, interchangeable power plants, in which the most advanced aerodynamic developments have been embodied to reduce both cooling drag and external drag to the minimum. The development of interchangeable power plants has been proceeding continuously and intensively over the past eight years, and the present examples incorporate the wealth of experience thus built up, with a high order of reliability, serviceability and accessibility.

Among the many things proved by the war is that modern air power—military or civil—demands a range of specialised aircraft—from the heavy bomber to the single-seater fighter; from the luxury liner to the slow cargo machine. This development is reflected in the plans of the company's aircraft division, which is building Britain's largest airliner, the Type 167 or "Brabazon I," which will weigh over 110 tons. The Bristol Freighter is in production to render the dual service to our foreign trade of carrying British goods to world markets and of itself being a British export. The Wayfarer—basically the same aircraft as the Freighter—is to meet the requirements of the traveller who wishes to fly at relatively low rates. To cater for yet another civil as well as military need, research is being actively pursued on a Bristol helicopter. On the military side, mention as yet may not be made of any future Bristol type.



New low-drag Hercules 100 power plant of advanced design. Accessibility for servicing is excellent.

Over 10,000 Bristol-designed gun turrets have been built since 1936, and Britain's latest bomber has a turret of the company's design. A Bristol air-sea rescue boat, the work of the designer of the celebrated "Miss Britain" power boat, is in an advanced stage of construction and will be powered by their own radial engines. Further, the company has taken an active part in the design and development of the light-alloy prefabricated house, known as the "Airoh" house, and an order has been placed for large numbers of these.

This survey, which from considerations of space has been brief, nevertheless does indicate the stature and varied interests of the Bristol concern.

THE WAY TO THE STARS

IN publishing the review of this film it is with a sharpened sense of pleasure that we unreservedly commend it to everyone. Somewhat naturally we have been irritated by the incredible *gaffes* perpetrated in the usual run of flying films, but *The Way to the Stars* is magnificent entertainment in every sense. It is technically accurate, extraordinarily powerful, most capably handled and provides a very real sense of sympathy with the story throughout.

All the players fit their parts with a naturalness that makes them live as real people—they act and speak just as normal everyday people do. The story itself is interesting and the direction of the film in presenting the story is masterly. What is of such great appeal, however, is that, for the first time in any film we have yet seen, British and Americans are portrayed as they really are—with just the right amount of national distinction such as is continually cropping up.

It is conceivably possible that Flt. Lt. Terence Rattigan, Anthony Asquith and Anatole de Grunwald got together and rigidly excluded all film-making licence.

S.B.A.C's NEW OFFICERS

MR. ARTHUR GOUGE, B.Sc., M.I.Mech.E., F.R.Ae.S., F.I.Ae.S. (U.S.A.), has been elected president of the Society of British Aircraft Constructors in succession to Major H. R. Kilner, M.C., who had been president since October, 1943. Mr. Robert Blackburn, O.B.E., chairman and managing director of Blackburn Aircraft, Ltd., has been elected vice-president.

Mr. Gouge is vice-chairman of Saunders-Roe, Ltd., having left Short Brothers after 28 years' service to join that company's board in 1943. Major Kilner, the retiring president, who is managing director (aviation) of Vickers-Armstrongs, Ltd., becomes deputy president.

The Commonwealth Conference

Problems and Prospects : The Need for Closer Co-operation

THIS month is pregnant with events which are likely to exercise considerable influence on the development of commercial air transport in the near future. Two important meetings are shortly to be held: the Commonwealth Air Transport Council in London and the International Air Transport Operators' Conference in Paris.

The provisional agenda of the Commonwealth Conference which opens on July 9th covers an entire field of urgent and important problems. They include a review of the progress and development of Commonwealth air communications; review of functions of the Commonwealth Air Transport Council and the composition and location of its secretariat; provision of meteorological and radio facilities along the routes; general developments in international civil aviation; proceedings of a meeting of sub-commissions of the I.C.A.N. (International Commission on Air Navigation) held recently in Paris; consideration of a paper to be presented by New Zealand on Commonwealth co-operation in research and development; and, finally, the proceedings of the Southern Africa Air Transport Conference will be discussed and the entire issue of Commonwealth air communications will come under review.

This is indeed a most wide and ambitious programme and it would be unreasonable to expect that during the relatively short time in which the conference will be in session everything will be settled there and then. Previous meetings have already revealed a measure of co-operation and an earnest desire of all members of the Commonwealth to pull together, but the coming meeting will be a further test of the extent to which these sentiments will be translated into action. One does not expect the progress to be hasty on matters so involved and intricate as those covered by the agenda, and perhaps many more deliberations will be necessary before a final pattern emerges.

Co-ordination

The object in view is clearly to establish a pattern of services which would eliminate duplications of effort and wasteful competition both on the Commonwealth routes and outside. This seems to be, in fact, a minimum requirement if aviation enterprise of Commonwealth nations is not to spend itself on a dissipated effort. The co-ordinated operation of routes in the intra-Commonwealth field, and perhaps more so in the international field, would sooner or later undermine the economic basis of air transport and produce a heavy charge upon the operating nations. In the long run, this would turn into a survival of the fittest, that is an economically more powerful unit, or one that is prepared to shoulder the dead burden of heavily subsidised uneconomical "prestige" air transport. As Mr. Hudson Fysh put it: "We would have the extraordinary spectacle of these services subsidised by their respective Dominion Governments against each other and the ludicrous position of the funds for subsidies coming from an outside source. The more the problem is probed the clearer the answer becomes in favour of Empire unity and co-operation in these matters."

From this point of view alone, the emergence of a common pattern for services to be operated within the Commonwealth and on some major foreign routes is doubtless in the interest of all—no less in the interest of the Mother Country than that of the Dominions. It would be an over-simplification to assume that with establishing this point the whole problem is settled and exhausted. Air transport is recognised to-day not only as a carrier of goods and passengers, but as an effective tool of political relations between nations and an essential part of their economic equipment. The regional interests of the Dominions will have to be brought into the general picture; their relations with their neighbours will have to fit into a general pattern as well as the growing desire of the Indian Empire and Colonial areas to secure for themselves a share in the Commonwealth air network.

To Canadians, for instance, the West Indies-Latin-American service seems to be holding particular interest because of extensive old-established trading connections in that area in which Canadian merchant shipping has long been active. In the Canadian view each Commonwealth member should operate the services or sections of services adjacent to its own territory. On external air routes Canada plans to operate services on an entirely Canadian basis, that is without such operations being merged in joint operating companies.

Regional Interests

On the vital U.K.-Australia route the co-operation between the B.O.A.C. and Australian Qantas is a well-tried and accomplished fact. On this route, however, which traverses India, Indian interests are keen on having an active share in the operation of services.

The South African route will also be, presumably operated on a partnership basis between the United Kingdom and the Dominions air transport.

In the South Pacific the trans-Tasman connection between Sydney and Auckland provides a practical demonstration of United Kingdom's, Australia's and New Zealand's interest in that area; although the war has interrupted the preparatory work for service from New Zealand to Vancouver this might yet mature at a later stage. Pacific islands clamour for closer knit air connections with the Commonwealth; Australia and New Zealand were reported to have been recently consulted about a project for a trans-ocean route by way of Fiji to Canada with supplementary eastern and western chains from Suva in the Fiji Islands linking the Gilbert and Ellice Islands with the Solomons and the New Hebrides.

These and other projects will call for agreement and co-operation with the U.S. Which, it is hoped, will be secured.

But it is utterly unrealistic to regard the attempts made at a closer Commonwealth co-operation as a retreat into the shell. Nor are they dictated by the policy adopted last winter by our transatlantic Allies at the Chicago Conference.

Any pattern of co-ordinated air transport that might emerge from the London meeting or at some later stages is simply the result of a logical process of mutual interests and a need for a better Commonwealth cohesion. And since for the present, a wider international agreement has not been achieved, this democratic Commonwealth co-operation may in fact provide a unique basis for closer collaboration with the U.S. and a nucleus for a world-wide system which is in the interest of international progress and peace.

MILES MARATHON

MILES AIRCRAFT, LTD., have just announced their intention of producing an additional aircraft to their already extensive range, this latest model to be known as the Marathon, whilst carrying the maker's designation M.60.

The machine is a high-wing, four-engined, all-metal aircraft with a tricycle undercarriage, and has been designed to conform with the recommendations of the Brabazon Committee. Two basic versions are scheduled, a fourteen-passenger medium short range model, and a freighter of 1,300 cu. ft. capacity to carry 2 tons over 750 miles.

We understand that a prototype is now being built and is expected to fly early next year. Until flight testing is undertaken, confirmation of the estimated performance cannot be given; nevertheless, the data put out by Miles gives a disposable load percentage of 33.9 of the tare weight, and in a tabulation of estimated operating costs the figure of 1.39d./per passenger mile *at full load* is quoted, which is undoubtedly a most attractive figure.

A summary of leading particulars gives the following: Span, 65ft.; length, 51ft. 6in.; height, 13ft. 3in.; cabin volume, 775 cu. ft. (passenger version); luggage and freight compartment volume, 350 cu. ft.; height of cabin in aisle, 6ft. 3in. Performance is quoted as: Still air range (normal tankage), 750 miles; maximum continuous cruise at 7,000ft., 210 m.p.h.; recommended economical cruise, 175 m.p.h.; corresponding fuel consumption, 42 g.p.h.; distance to unstick (full load—still air), 500 yards; initial rate of climb, 1,300 ft./min. Normal payload is fourteen passengers, plus 1,150 lb. of luggage and freight, or 4,600 lb. of freight.

These figures are based upon the use of four 330 h.p. de Havilland Gipsy Queen 71 engines, but alternative power units are listed as: Two 850 h.p. Armstrong Siddeley Cougars; four 500 h.p. Alvis Leonides; or two 700 h.p. Rangers. It is also claimed that the Marathon will be extremely easy to handle with one engine inoperative, and, further, that it will climb at 700 ft./min. at full load in this condition. No indication is given, however, as to whether it is the four- or the twin-engined version to which this applies.

CIVIL AVIATION NEWS

GOOD GOING

IN 9½ hours an R.A.F. Transport Command Liberator covered the journey from Perth to Sydney, 2,100 miles, in a non-stop flight.

The 1940 record was 12 hours.

DRAFTING AIR RULES

THE Legal Committee of I.C.A.N. which met recently in Paris concluded its work on the final stage of drafting amendments and modifications of the technical annexes to the Paris Convention.

The next stage is to submit these amended annexes to the plenary session of I.C.A.N., which was to take place in London this month, but will probably be postponed.

OFFICIAL ACCEPTANCE

THE signature affixed on behalf of the Government of the united Kingdom and Northern Ireland to the Interim and Transit Agreements shall constitute a binding acceptance of the agreement.

In a note to the U.S. Acting Secretary of State transmitting this information the British Ambassador stated that "in signifying their acceptance to the said agreements, the Government of the United Kingdom desires to make it clear that they neither regard the Governments of Denmark and Siam as being parties thereto nor consider the United Kingdom as being in treaty relations with either of these countries in respect of the agreement."

SERVICE TO CAPETOWN?

IT is midsummer already and there is still no news of the long-promised trunk service to Capetown. Ever since Viscount Swinton's visit to South Africa in March it was hoped both in this country and in the Union that this service, so vital to Commonwealth relations and trade, would be put into operation as priority No. 1.

The delay in establishing the service, which was to start in May and then in June, can hardly be attributed to political reasons. The Commonwealth Air Transport Conference revealed complete co-operation and accord of plans for future. If shortage of aircraft is the cause, one would expect that to avoid further delays the frequency of some other services would be reduced to make machines available to meet this pressing and urgent task.

INDIAN OCEAN TRAFFIC

FOUR return services each week across the Indian Ocean from Western Australia to Ceylon are now being operated by Qantas Empire Airways.

The service was originally maintained by five Catalina flying boats until two converted Liberator bombers were added to the fleet. The landplanes, forming the "Kangaroo" Service, reduced the time of crossing by nearly ten hours.

To-day the 3,000-odd mile non-stop ocean crossing in each direction is made weekly by a Catalina flying-boat, twice per week by Liberator aircraft, and, following the commencement of the direct service from Sydney to London, once weekly by Lancastrian mail aircraft.

LE BOURGET

LE BOURGET, famous peacetime airport in Paris, battered by Allied bombs during the German occupation, is now almost fully repaired and able to handle 1,000 aircraft movements a day—a figure that would have sounded fantastic before the war.

During peak periods the R.A.F. flying control at Le Bourget has handled as many as 147 aircraft an hour—or more than two a minute.

One of the busiest of R.A.F. Transport Command airfields on the Continent, Le Bourget now copes with hundreds of passengers and tens of thousands of pounds of freight and mails every 24 hours. The main buildings—gaunt ruins only a few months ago—have been largely restored, and comfortable waiting rooms and buffets for passengers and aircrews are up to peacetime standard. Painters and decorators are putting the final touches which will make Le Bourget the finest airport in Europe from a structural point of view.

SUNDERLAND SALE

ARGENTINA is reported to have purchased four converted Sunderlands.

The boats will be used for commercial air transport.

SCOTTISH HOPES

LEUCHARS AIRPORT, Fifeshire, may still be used for flights to Scandinavia and Denmark, although the B.O.A.C. is moving from there to Croydon. It was hoped that after the war Leuchars would be developed into an "East-coast Prestwick," and concern was felt in the county when it was intimated that the B.O.A.C. was moving south.

Mr. J. Henderson Stewart, M.P. for East Fife, who took the matter up with the Ministry of Civil Aviation, was informed that since the Government proposed to reserve services from Scotland to the Scandinavian countries, including Denmark, to Scottish enterprise, it was, therefore, not possible at the moment to say from which airfield this route might be run. This would be entirely a matter for the licensing tribunal to decide.

CANADIAN SURPLUS

CANADA sold in recent months 110 surplus aircraft through the Government-owned War Assets Corporation, Montreal. Sales were made primarily to Canadian companies, both air transport and general business, and to three United States firms, namely, Pan-American Airways, Gulf Oil Co., and Chas. H. Babb and Co. Sales included 53 Fleet Cornell trainers, Stinson transports, Grumman Goose amphibians which averaged $23,300 each, Hudson bombers which sold at an average of $10,000 each, Lockheed transports which sold at an average of $13,600 each, Cessna Cranes, de Havilland Dragonfly, Oxford and de Havilland Tiger Moth trainers.

—AND AMERICAN

SURPLUS Lodestars are being converted at Lockheeds for private purchasers whose proposed usage satisfy Government regulations as to war importance and need.

Typical recipient is the Colombian Petroleum Co., of Colombia, South America. Their Lodestars have flexible interior arrangements for use as personnel transport, freighter or standard airliner. A number of other companies and Govenment agencies have purchased reconverted Executive types. These purchasers include the Standard Oil Co., the Goodyear Co., U.S. Foreign Economical Administration, Canada's Department of Munitions and Supply, etc.

AMERICAN ROUND-UP

SINCE the recent cuts in U.S. military aircraft production and the consequent relaxation of restrictions on the manufacture of commercial aircraft and components, aircraft manufacturers on the Pacific Coast are moving into commercial production in an endeavour to secure an early output.

The relaxation has been made subject to the provision that military schedules are met, and for this purpose the War Production Board has issued detailed instructions and procedures. Work on hundreds of millions of dollars in commercial orders is to be launched as soon as military contracts are met.

The Boeing Company, which is meeting its military commitments on schedule, finds itself well placed for the change over, due to the fact that they have B-29 production lines in operation and that the B-377 Stratocruiser is a sister ship of the long-range bomber. Prospects for early deliveries of Stratocruisers seem to be good.

In a recent statement by the company's chairman, C. L. Egtvedt, it was stated that Boeing are negotiating with several airlines for the sale of Stratocruisers and that production of this type "may be built for commercial operation much sooner than was once expected."

In addition to the Stratocruiser, Boeings also expect to be in the post-war market with other types and sizes of commercial aircraft, having under development intermediate or feeder types. It is understood that the company is also studying the private aircraft field and designs for such types, but as yet no announcement has been made on this subject.

The Douglas Company has a backlog of contracts for commercial aircraft amounting to $129,000,000. The types involved are the DC-4, DC-6 and DC-7. While plans for the

CIVIL AVIATION NEWS

manufacture of these types are well advanced it seems that some time will yet elapse before they are translated into action. In this task a considerable amount of co-operation with Government agencies will be essential to assist in the diverting of manpower and materials into commercial production. In the view of Donald W. Douglas considerable study is necessary to determine when, where and how they can begin to build the much-needed aircraft for the airlines, and it will be necessary for the Government to realise that the gradual reconversion from wartime to peacetime production is in fact a national problem.

The Lockheed Company has now about $150,000,000 in commercial contracts on their books. Lockheed has stopped work on the Saturn twin-engine feeder liner, but now hopes to get the necessary man-power and to be ready to supply feeder line operators by 1946. But this estimate seems rather too optimistic.

To enable the company to switch over in time to commercial production the Army is to be asked to advance by six months to end all orders for the Constellation. In that case, production of Constellations for the airlines could start in February, 1946.

On the theory that the small aircraft may represent the best opportunity for mass production, Lockheed is experimenting with a single type and may (but this is by no means certain) endeavour to enter the private aircraft field. The aircraft under experiment is a little two-cylinder 800 lb. job which will probably sell for $800.

North American's military commitments are reported to be so heavy that the production of transport and private aircraft cannot at present be entertained. From statements of company officials it seems that they consider military models paramount and that the policy of the company will be to concentrate on the production of military types even after the war.

Consolidated Vultee hopes to get into production on its Convair Model 37, a 160 ton, six-engine aircraft—the largest of its post-war types—as soon as war conditions permit. Pan-American has ordered a fleet of 15 of these airliners, built as a 204-passenger de luxe version for transatlantic and transpacific services.

Consolidated production of commercial types will be assisted by stoppage of work in some of the company's plants on such well-known military types as the B-32 and the B-24.

To conclude the round-up, one might mention that neither Northrop nor the Ryan Company are effected by the W.P.B. relaxation order because of their heavy commitments on military production.

VENEZUELA

LINEA AEROPOSTAL VENEZOLANA, the Government-owned air transport company, has recorded a steady increase in its operations during the past five years. This increase, shown on the following table, was accomplished by an extension of the network, mainly the western parts of Venezuela.

Item	1940	1941	1942	1943	1944
Kilometres flown ...	908,557	1,357,200	1,386,661	1,684,495	2,014,980
Hours flown	3,842	5,436	5,780	6,809	8,159
Number of flights ...	5,166	7,072	8,309	9,287	9,814
Number of passengers	12,112	16,133	20,371	26,745	32,893
Cargo (metric tons, exclusive of baggage)	182	370	442	595	762
Mail (metric tons) ...	34	39	41	55	81

Another operator, the *Aerovias Venezuelas S.A.*, which commenced activities in November, 1943, has also experienced considerable progress. This company is mainly engaged on freight carriage for the petroleum industry. Services over the company's network in eastern Venezuela have been approved, a new service established between Maiquetia and San Fernando de Apure, and a licence was secured for the operations of the route between Maiquetia and Maracaibo.

Complete operational and traffic figures are not at hand, but the increase in freight volume carried is shown by the fact that while the monthly average in the first half of 1944 was 20.8 tons, by December the same year it amounted to 67 tons.

CANADIAN STATISTICS

FARE-PAYING passengers carried by Canadian civil aircraft in 1944 totalled 386,719, against 299,279 in 1943, a rise of 29 per cent. International traffic increased by 39,539 passengers, and traffic of Canadian licensed carriers by 52,085 passengers. Traffic of unlicensed carriers increased by 623 passengers.

Revenue freight decreased from 11,970,909 lb. in 1943 to 10,812,867 in 1944. Mailed also recorded a decrease, from 7,393,812 to 6,716,167.

Operating revenues of Canadian licensed air carriers advanced from $15,875,319 in 1943 to $16,707,809, but operating expenses rose from $15,928,397 to $17,438,035. Thus the operating deficit increased from $53,078 to $730,226.

EXPORTS BY AIR

THE Rootes Group of British motor vehicle manufacturing companies are already planning to export vehicle spares by air when necessary to all parts of the world.

Such arrangements will supplement normal facilities in foreign territories which, despite the war years, have been maintained by the group. One of the difficulties of all motor manufacturers engaged in export before 1939 was to provide quickly spares required urgently in remote and sparsely populated countries.

Much will depend on air freight rates, speed and regularity, and no scheme for sending freight by air can be settled, of course, until details of future routes are known. But air transport should lend itself admirably to many industrial needs as it is often the small parts that prove the most vital and are those which are needed with the minimum delay.

MEXICAN AIR

LINEAS AEREAS-MEXICANAS, S.A. (known as LAMSA), a Mexican corporation controlled by United Air Lines, have been granted an extension of a temporary C.A.B foreign air carrier permit for transportation of persons, property and mail between Cananea, Sonora, Mexico, and Nogales, Ariz., U.S.

LAMSA has been maintaining its Mexican service through Nogales, Ariz., since October, 1944, when it obtained temporary permission from the Board for such operation due to airport conditions at Nogales, Sonora, Mexico.

NATIONALISED

FRENCH air transport companies are to be nationalised under a decree published in the French official gazette to-day.

Shares of the "Air France" Co. are to be taken over by the State as well as those of the "Air Bleu" and "Air France Transatlantique" companies. Shares held by foreign Governments are, however, excluded from this measure.

SERVICE TO OSLO

R.A.F. Transport Command which since June 11 has been operating a regular air service for official passengers between London and Copenhagen has recently extended the service to Oslo. Two aircraft each way a day are operating over the route.

Other R.A.F. Transport Command aircraft from provincial and Continental bases make frequent flights to Copenhagen for official purposes.

SWEDEN'S FIRST

FOR the first time a Swedish aircraft, a converted Flying Fortress, left Sweden on a scheduled transatlantic flight bound for the U.S.

The flight was operated by S.I.L.A., a company formed some time ago by A.B. Aerotransport and shipping interests, and marked the first step towards the realisation of S.I.L.A.'s plans to establish a number of intercontinental services.

AIRPORTS IN EIRE

REVIEWING the work which had been done on the building of airports in Ireland in a speech to the Dail in Dublin, the Eire Minister for Industry and Commerce said that the work of construction at the Shannon Airport was proceeding as well as possible with the limited equipment which is available at the present time.

It was hoped that the works in progress at Foynes (the flying-boat section of the airport, on the south side of the Shannon) would be completed this year, and that the dredging of the river at Rineanna and the erection of the temporary terminal building would also be completed.

Plans for the construction of the permanent terminal building for the land plane base at Rineanna are well advanced, and work would be started as soon as there was a reasonable prospect of materials being available.

"Indicator" Discusses Topics of the Day

Maintenance Efficiency

Reducing "Hangar Costs" : Efficiency versus Accessibility

DURING this war as, to a smaller degree, during the last, aircraft and engine design have made tremendous strides. But, as we all know quite well, these strides have not always, from the peacetime operational point of view, been in the right direction. Designers, manufacturers and, most important of all, the operators (in the form, for the present, of Service maintenance officers and crews) appreciate this only too thoroughly.

In due course, many of the individual members of these crews will find themselves working for airline operators, while the workshops, operations rooms, and costing departments will be staffed by individuals who may have been in the Service and dealing with Service aircraft types. Most of them, therefore, will know something of the problems involved in keeping these over-complicated mechanisms in the air, day by day, with an economic minimum of skilled man-power.

But the general public is certainly not aware of the difficulties, and I sometimes wonder whether many of the Big People in prospective airline operation are as fully informed as they should be of the problems and of the necessity of redesigning, when dealing with the civil market, for maintenance, ease and accessibility, even if this has to be at the cost of ultimate performance. Certainly, the general public will expect to be conveyed at the sort of speeds about which they have read in connection with cost-no-object military aircraft, and the Big People may not appreciate the cost, in extra maintenance hours, of the necessary cleanliness.

The time is coming when that part of the aircraft industry which is interested in civil development must, in consultation with the operators and their maintenance and costing staffs, strike the balance between performance and running costs. So far, we appear to have been concentrating largely on the very important *direct* running costs in relation to loads and speeds. But it seems to me that overheads in the form of day-to-day maintenance and periodic overhaul costs are likely to equal those merely of the consumption of fuel and oil and the salaries of those directly concerned with a series of scheduled runs.

M.P.H. for Man Hours

Far-reaching decisions will have to be made in the course of design and development. I must say that, if I were concerned with an airline project and had ordered a new type, I should have my maintenance and operating staff camped out at the constructor's works in order to watch the disposition of vital items from the maintenance and operating angles while the design people were still at work, and would be prepared to accept the loss of a few cruising miles an hour in return for a few hundred man-hours saved in the hangar.

After all, a great deal of the advantage of operating a clean and efficient aircraft, capable of paying its way as far as direct running costs are concerned, is lost if it is expensive to maintain. It may take, for instance, one man only five minutes to adjust the constant-speed stop, but it may take two hours of two men's time to replace the beautiful cowlings which have to be removed before the stop can be reached. A designer may think out a most aerodynamically efficient way of mounting a power unit, but the advantages are lost if the engine has to be removed every time a plug change is necessary. Because of the lengths of the pipelines involved, and the comparative structural weakness of tanks, the use of auxiliary electric immersion pumps may be necessary for full-power take-off conditions—or even merely as a safeguard in case of engine-pump failure—but we are back where we started if, in order to remove an unserviceable pump, the wing must be stripped and the tank in question taken out.

A friend of mine, for his own amusement, worked out a few very approximate costs for the storage, servicing, and necessary modification of aircraft at a maintenance unit. I won't quote the figure, since memory is a poor guide and the various bases of the calculation were only approximately accurate, but it was an alarmingly high one in proportion to the supposed initial costs of the aircraft in question. Needless to say, a great deal of work must necessarily be done at such a unit which would not normally be done on aircraft in regular service, and, in order to allow for sudden demands, the strength of the unit was probably much greater than would be considered necessary in peacetime conditions. But the calculation still gave one something to think about when it was realised that a great deal more than half the cost was concerned with quite incidental work which, in many cases and with properly considered layouts, could be avoided.

Added Complication

I am merely contending that sufficient attention has not, so far, been paid to the problem and that war conditions have tended to make relative accessibility a comparatively unimportant point in the minds of manufacturers. More important still, aircraft have, almost unnoticed, become nearly twice as complicated and fully equipped as they were before the war. I am not, of course, alluding to the items of purely offensive and defensive equipment, but to the auxiliaries and hordes of odds and ends that are necessary to keep large, high-efficiency aircraft in the air. Civil aircraft, particularly from across the Atlantic, were just beginning, in pre-war days, to "grow" many of the items which have become standard equipment, but such items were still in comparatively simple form.

To-day, a properly organised transport type may have two alternative emergency undercarriage and flap systems, with hydraulic pumps on all engines. It may have vacuum pumps on all engines. It may have two-speed, two-stage blowers with inter-coolers and, even, an electrically operated altitude switch for automatic change at a pre-set height. It has automatic boost and mixture controls. It has feathering booster motors and, maybe, pitch-reverse gear. It may have immersion pumps in all tanks, with a tank pressurisation layout for high-altitude flying—not to mention a cabin pressurisation system, and, perhaps, oxygen laid on for each passenger. It may have power-driven semi-servo controls, and power-driven trimmer tabs with emergency override mechanism. It will probably have electrically operated engine temperature and pressure instruments, and electric tachometers. It will undoubtedly have de-icing gear with the attendant pumps and pipelines, as well as built-in automatic pilot and D.R. compass relay. One can go on indefinitely. The entire structure is a maze of concentrated electric and hydraulic plumbing such as would send a submarine designer into the nut-house. And every little item should be capable of being checked and mended or replaced with the wastage of as little highly-skilled man-power as is conceivably possible.

It is, I feel, from the maintenance rather than the efficiency angle that all civil aircraft design must be attacked if running costs are to be kept down. And the firm or country which produces the most ingenious answer to the various problems, while offering an aircraft which is "balanced" in operating efficiency, will be likely to do fairly well in the world's markets. The entire subject—supported by some well-chosen man-hour figures which will no doubt be produced—should provide sales representatives with an entirely new line in "sales talk."

"INDICATOR."

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers not necessarily for publication, must in all cases accompany letters.

AIRCRAFT NOISE

Harvard and Oxford V.'s Terrific Din

I WOULD like to reply to W. R. Campbell's letter on "Aircraft Noise" which appeared in *Flight*, June 21st.

The aircraft he saw was almost certainly a North American Harvard trainer, and the very characteristic noise that these aircraft make is caused, I believe, by the high tip speeds of the airscrew.

I live in an area where we see and hear large numbers of Harvards, and so I can quite appreciate Mr. Campbell's anxiety for the population, but I feel sure that he will see that it is unavoidable and, as he puts it, not "simply a stunt."

Another aircraft that also makes this terrific din is the Airspeed Oxford V, and as these aircraft have done such excellent work in training aircrews throughout the war years I for one don't mind putting up with it. W. PARKER.

RADIO TARGET PLANES

Similar French and American Types

IN *Flight*, May 31st, 1945, there appeared a photograph of an American radio-controlled target-tug described as being powered by a 2-cylinder, horizontally-opposed, air-cooled engine driving two twin-bladed fixed pitch contra-props. You stated also that it is catapult-launched.

I was reminded of this on looking through an old French magazine the other day. This was *La Science et la Vie* dated March, 1940. At the end of an article on Army Co-operation there was a footnote about radio-controlled pilotless target planes. One of these was credited with a ceiling of 5,000ft, a span of 11ft. 9¾in., and a single engine driving two propellers, presumably counter-rotating. It is launched by catapult and guided by radio to the spot where hopeful gunners are waiting for it. It then flies on, and the motor is cut out by radio. Then the plane sinks gently down to earth by parachute and lands on a tricycle undercarriage. This queer method of landing is intended to save the radio apparatus from serious jerks.

Is there any connection between these two planes, and has anyone more information on either?

With congratulations on the standard of your journal.

NORMAN K. S. BAKER.

AIRLINE SERVICING

Independent Facilities are Plentiful

LET me say, straight away, that this letter is written because I have a personal interest in servicing, as well as because, if adopted, my proposals would be of benefit to British civil aviation.

One of the great problems which we have to overcome during the post-war era is the prevention of duplication and the resultant waste of public and private money.

During the war, the pre-war aircraft and engine repair and maintenance firms, and at least one firm which has devoted its sole energies to building up an instrument and electrical test house and servicing station, have accumulated a fund of knowledge and experience which, if we are not careful, will be lost. The existing facilities are capable of handling many times the repair and maintenance requirements of all airlines ever likely to fly to or from this country. At the same time, airline-operating companies are spending vast sums on new enterprises, instead of co-opting the services of existing organisations. What will be the result? Probably, existing organisations, which have been part of the mainstay of our industrial war effort in England, will, in many cases, fade out of business, to be replaced by many new organisations duplicating those which already exist. This inefficiency has already started in certain instances.

I am not blaming the airline operators if they do not know of the existence of these firms. But what M.A.P. should encourage, right now, and what the Minister for Civil Aviation should give his attention to, is the wealth of independent servicing facilities already available, which will assist him to operate airlines on a more competitive basis than any other country in the world.

Are these servicing firms to go by the board? Organisations capable of doing a C. of A. to several aircraft each week, repairing 20 to 40 high-powered engines and repairing, testing and servicing literally hundreds of instruments, magnetos, generators, engine starters every week, *exist to-day. They are independent;* that is to say, they owe no allegiance to any manufacturer of a proprietary article, and would thereby ensure unbiased service, as does an insurance broker who is not tied to a particular insurance company.

Plying abroad, as well as at home, these service organisations could help to sell British products, and build up for Great Britain an international reputation for both "Service" and the high quality of British goods, giving the airline operator a clear field to devote his whole energies to flying his routes in the knowledge that, mechanically, he is going to be able to do so trouble-free as far as is humanly possible.

If these suggestions are adopted, we could go a long way to preserving those firms whose normal trade is, and always has been, aircraft, engine and instrument repair, maintenance and testing, leaving those firms who have stepped out of their pre-war trade to return to it. This is an important point, because firms which have been directed into aviation should be encouraged and given every facility to return to their pre-war activities, thereby helping trade as a whole and preventing, at the same time, their using the easy, almost automatic "work-without-fighting-for-it" period of war to compete against those whose pre-war trade was, and always will be, aviation.

These old firms have done a good job during the war, and have spared no effort. If they are not to be encouraged, their highly skilled personnel will drift into other industries and the nation will lose, for the Royal Air Force, one of the finest insurances against some of the enormous difficulties which it experienced during the early years of this war.

I understand, and it is worthy of note, that certain American operators have already adopted similar proposals to the above and have found them to be sound. J. R. BRYANS.

GETTING OVER THE "HUMP"

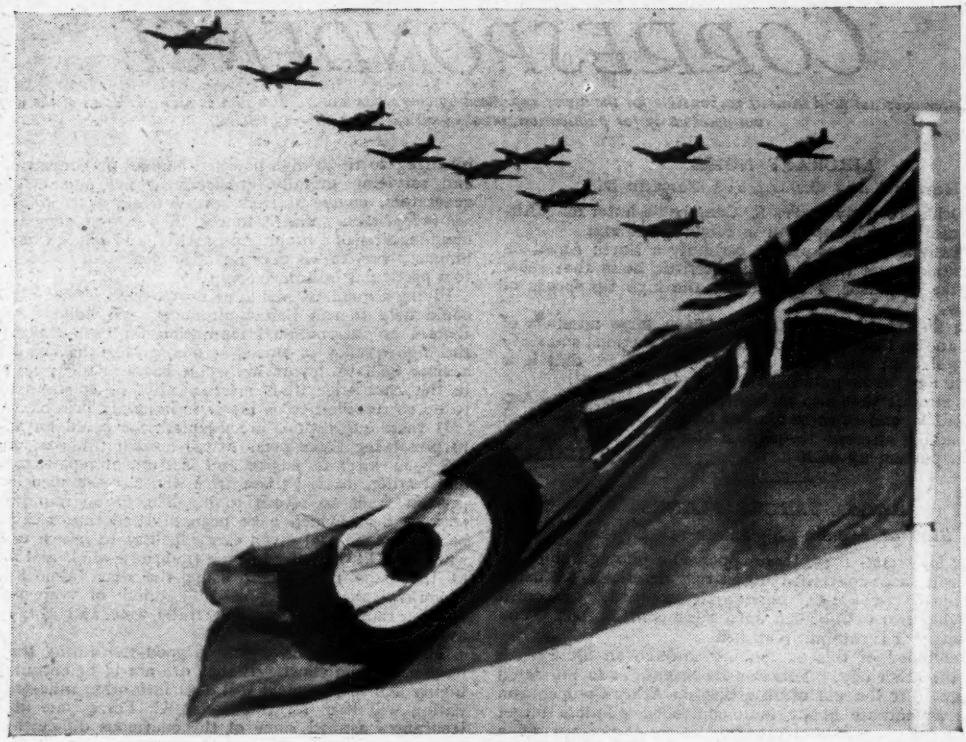
Trade Tours for Test Pilots

MAY I, somewhat belatedly I fear, make a few remarks following up "Indicator's" ideas on the position of experimental test pilots? (*Flight*, May 3rd.)

Whilst not agreeing that it is necessary, or even possible, for our test pilots to be "equally at home in the air or behind the water-cooled slide-rule," I do feel that a great many of their difficulties are caused by the fact that the average technician is not capable of grasping the practical essentials of flying as it really is. In the course of a number of years I have often had to sit back patiently, while otherwise intelligent drawing office chaps have made quite astounding suggestions and offered futile comments on handling problems.

Somehow or other this gap between pilots and technicians must be bridged. Only a few weeks ago, after a friend of mine had, with the greatest difficulty, landed an experimental aircraft, he was told by one of the designers that he should pass out the aircraft as, "according to calculations" there could be nothing wrong with the elevator control! Nearly all handling problems have, in the end, to be sorted out by the pilots themselves. I wonder how long it was, for instance, before the technicians really believed in skin "panting" as a source of control difficulty at high speeds? From what one can gather, our American friends suffer from the effects of the same quiet battle between the pilot, the technicians and the production people, who are naturally keen to get on with the job. It is possible to guess who of the three has won when we compare the handling qualities of the different American types in use.

Might I suggest that it would be an excellent thing if the various firms' test pilots made periodic tours around the industry, flying the different types and comparing notes with the resident pilots? Even the best of pilots can develop stereotyped ideas of what constitutes "good" handling qualities, and a little outside support over handling problems would often be of immense help both to the resident test pilots and to the technical staff. We are all learning, and we bear no grudge against our technical friends, with whom we are usually on the best of terms and for whose efforts we have the greatest possible respect. S. T. P.



THE D.A.F. GO BY: An impressive picture from the Fly-past of the Desert Air Force before Air Marshal Sir Guy Garrod, K.C.B., O.B.E., M.C., D.F.C., on the Campoformido airfield in Northern Italy.

SERVICE AVIATION

Royal Air Force and Fleet Air Arm News and Announcements

Awards

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations.

Distinguished Service Order

Act. Wing Cdr. P. DOBSON, D.F.C., A.F.C., R.A.F.V.R., No. 158 Sqn.—As squadron commander, this officer has consistently displayed leadership, gallantry and determination of a high order. On one occasion, his aircraft was engaged by heavy and accurate fire from enemy ground defences and he sustained a wound in the left leg. In spite of this, he held the aircraft straight and level on its course and pressed home a good attack. Not until the enemy coast had been crossed *en route* for home did Wing Cdr. Dobson draw attention to his injury. Although in great pain and suffering from the loss of blood, he remained at the controls and flew the aircraft back to base. He displayed unbeatable determination and devotion to duty in the face of much physical distress.

Act. Wing Cdr. W. F. GIBB, D.F.C., R.A.F.V.R., No. 239 Sqn.—Wing Cdr. Gibb has completed very many sorties since being awarded the D.F.C. Highly efficient, brave and resolute, this officer has set a splendid example to all. Among his successes is the destruction of five enemy aircraft, three of which he shot down in the early days of March, 1945.

Act. Wing Cdr. J. R. St. JOHN, D.F.C., R.A.F.O., No. 103 Sqn.—This officer has completed three tours of operational duty. His record is one of gallant and distinguished service. By his skilful leadership, exceptional ability and unswerving devotion to duty, Wing Cdr. St. John has contributed in good measure to the successes obtained.

Act. Sqn. Ldr. B. A. TEMPLEMAN-ROOKE, D.F.C., R.A.F.V.R., No. 576 Sqn.—This officer is an outstanding pilot and a highly efficient flight commander. He has completed a very large number of sorties and throughout has displayed the highest standard of bravery and devotion to duty. Sqn. Ldr. Templeman-Rooke has invariably participated in the most hazardous of the missions for which the squadron has been detailed and his unconquerable spirit has set a magnificent example.

Act. Wing Cdr. C. D. NORTH-LEWIS, D.F.C., R.A.F.—(since being awarded a Bar to the D.F.C., this officer has participated in a large number of sorties, involving attacks on a wide range of targets in various battle zones. By his skilful leadership, great tactical ability and iron determination, Wing Cdr. North-Lewis has played a good part in the results obtained. On one occasion this officer flew with great distinction in a successful attack on an enemy tank force which was greatly threatening our ground forces in an area in the Ardennes. Wing Cdr. North-Lewis has accomplished much brilliant work.

Act. Sqn. Ldr. J. R. MUSGRAVE, R.A.F.V.R. (Lt., Royal Regiment of Artillery), No. 178 Sqn.—Now on his second tour of operational duty, Sqn. Ldr. Musgrave has constantly displayed a high standard of skill and devotion to duty. As a flight commander, both in the air and on the ground, he has set a magnificent example to those serving under him. This officer's tour has been marked by his courage and determination to complete his mission undeterred by either enemy opposition or adverse weather. He has attacked heavily defended targets in Salonika, also at Bronzala, Szombathely, Vérona and the railway sidings at Sarajevo. On one occasion Sqn. Ldr. Musgrave completed a telling attack on a vital target, at a low level, despite appalling weather.

Act. Wing Cdr. H. R. MacD. BEALL, R.A.F., No. 356 Sqn.—Wing Cdr. Beall took over command of No. 356 Squadron during its formation and has been entirely responsible for the build-up and training of this unit into a high standard of operational efficiency. He has completed two tours of operational duty and has flown on a large number of sorties, both in the European and Far Eastern theatres of war. This officer has always displayed leadership of a high order and has invariably pressed home his attacks with determination and skill. The excellent results achieved by the squadron have been largely owing to the enthusiasm and brilliant leadership of this officer.

Wing Cdr. T. B. MORTON, R.A.F.O., No. 100 Sqn.—This officer, now on his third tour of operational duty, has completed a large number of sorties against a variety of strongly defended targets. On one occasion in March, 1945, he was detailed to attack an oil installation at Misburg. During the bombing run, his aircraft was illuminated in a cone of searchlights and heavily engaged by anti-aircraft fire. In spite of this, Wing Cdr. Morton held to a steady course and enabled his bomb aimer to attack the target with precision. Wing Cdr. Morton has displayed the highest standard of skill, coupled with the greatest determination to bring his missions to a successful conclusion. Undaunted by the heaviest of opposition he has invariably pressed home his attacks, setting a fine example to all under his command.

Flt. Lt. T. R. BURNE, A.F.C., R.A.F., No. 41 Sqn.—This officer has displayed outstanding gallantry in air operations and throughout his example of devotion to duty has been unsurpassed. Whilst serving in the Far East theatre of war, Flt. Lt. Burne was badly wounded. As a result his right leg was amputated below the knee. This in no way diminished his zest for operational flying and, on his recovery, he became a fighter pilot. Since joining his present squadron he has participated in many sorties during which he has most effectively attacked numerous enemy locomotives, much mechanical transport and a number of barges. In February, 1945, Flt. Lt. Burne took part in an attack on an enemy target. Fierce anti-aircraft fire was encountered. Nevertheless, this pilot pressed home his attack from a low-level. The aircraft was hit and Flt. Lt. Burne was badly wounded in the chest and his right arm was rendered useless. Although in much physical distress he flew the aircraft back to base where he gallantly allowed another pilot in trouble with a damaged aircraft to effect a landing first before coming down himself. This officer has set an example in keeping with the best traditions of the Royal Air Force.

F/O. S. J. SYKES, D.F.C., R.A.A.F., No. 455 (R.A.A.F) Sqn.—This officer has completed a large number of sorties, including many attacks on enemy shipping, during which he has shown the highest standard of skill and resolution. His example of courage was amply demonstrated on one occasion in April, 1945, when he led the squadron in an attack on a target at anchor in the

South Fjord. Whilst pressing home his attack F/O. Sykes was severely wounded, being affected in the arm and leg. Despite this, he completed his attacking run. Although suffering acutely he flew his aircraft to base and executed a perfect landing. This officer set a magnificent example of courage, fortitude and devotion to duty.

Lt. Col. D. P. TILLEY, D.F.C., S.A.A.F., No. 19 (S.A.A.F.) Sqn.—Lt. Col. Tilley has an outstanding record as an operational pilot. He has participated in a very large number of sorties against a wide variety of targets. In February, 1945, he led a formation of aircraft in a carefully planned attack against a medium-sized armed merchantman lying in the port of Fiume. With considerable determination and accuracy this officer pressed home his attack, obtaining hits on the vessel amidships. The destruction of the vessel, without loss to his formation, was largely due to the careful planning and skilful leadership of Lt. Col. Tilley. The successes he has achieved are a fine tribute to his sterling qualities.

Bar to Distinguished Flying Cross

Act. Flt. Lt. V. E. BOWDEN, D.F.C., R.A.F.V.R., No. 405 (R.C.A.F.) Sqn—Flt. Lt. Bowden has proved himself an extremely courageous and capable bomb aimer who has completed two tours of operational duty. He has, at all times, displayed outstanding enthusiasm for operations and has attacked many of the major targets in German territory. Since the award of the D.F.C., this officer has continued to operate with the utmost skill and determination.

Act. Flt. Lt. D. T. BURKE, D.F.C., R.A.F.V.R., No. 105 Sqn.—Flt. Lt. Burke has completed many outstanding operational sorties since the award of the D.F.C. Many of these have entailed difficult and dangerous duties. His skill, courage and devotion to duty have always been most praiseworthy. Whatever the degree of enemy opposition encountered, this officer has always completed his missions with efficiency and has produced results of the highest order.

Act. Flt Lt. J. E. DAVIDSON, D.F.C., R.A.F., No. 7 Sqn.—Since the award of the D.F.C. this officer has taken part in many more operational sorties. In the majority of these sorties he has served as flight engineer in the aircraft of the master bomber or deputy master bomber. He has at all times displayed outstanding courage, cheerfulness and unselfish devotion to duty.

Act. Flt. Lt. F. EASTON, D.F.C., R.A.F.V.R., No. 640 Sqn.—Flt. Lt. Easton has completed his second tour of operations which has included attacks against Sterkrade, Bingen, Hanau, Mainz and many other industrial targets in the Ruhr Valley. He has shown himself to be a skilful and determined pilot and captain of aircraft and, as deputy flight commander, he has led his squadron with outstanding courage and success, undeterred by intense enemy opposition. Since the award of the D.F.C., Flt. Lt. Easton has continued to maintain a high standard of airmanship and devotion to duty which, combined with his fine fighting spirit and tenacity of purpose, has set a magnificent example to all members of his squadron.

Act. Flt. Lt. B. W. G. FELGATE, D.F.C., R.A.F.V.R., No. 156 Sqn.—Since the award of the D.F.C. this officer has continued to operate with courage, enthusiasm and devotion to duty of a high order. He has participated in numerous operational sorties against a wide range of targets. His aircraft has been in combat on many occasions and at all times he has displayed outstanding skill and determination.

Act. Flt. Lt. F. B. GIPSON, D.F.C., R.A.F.V.R., No. 582 Sqn.—Since being recommended for the D.F.C. this officer has completed an extended tour of operations in a most exemplary manner. He has always shown a high order of skill, courage and determination and his crew have achieved a high standard of target marking over a long period. This has been largely owing to the fine leadership, courage and enthusiasm of Flt. Lt. Gipson.

Act. Flt. Lt. G. GRAHAM, D.F.C., R.A.F.V.R., No. 7 Sqn.—Since the award of the D.F.C., Flt. Lt. Graham has continued to display a high degree of courage and determination. He has taken part in a large number of operational missions, many of them with a target marking crew. Of outstanding ability, this officer has set a fine example to the rest of the squadron by his complete devotion to duty, exceptional courage and enthusiasm.

Act. Flt. Lt. P. A. GREENAWAY, D.F.C., R.A.F.V.R., No. 7 Sqn.—This officer has at all times displayed a high sense of duty and great courage in his duties as air bomber. Since the award of the D.F.C. he has taken part in numerous operational sorties against highly fortified enemy targets. His gallantry in the face of danger has always been a source of confidence to his crew.

Act. Flt. Lt. R. C. LAKE, D.F.C., R.A.F.V.R., No. 9 Sqn.—Now on his second tour of operational duty, this officer has attacked some of the most heavily defended targets. On several occasions he has been selected to play a responsible role during special daylight operations. On one occasion, Flt. Lt. Lake's aircraft was attacked by three Ju. 88s simultaneously, but by his skilful airmanship combined with good crew co-operation, one of the enemy aircraft was shot down. This officer has always shown a fine fighting spirit and great courage and determination in the face of the enemy.

Act. Flt. Lt. A. MAITLAND, D.F.C., R.A.F.V.R., No. 7 Sqn.—Flt. Lt. Maitland has at all times displayed high courage and determination, even under the most hazardous circumstances. He has participated in many further operational sorties since the award of the D.F.C. with excellent results. His devotion to duty at all times has been most noteworthy.

Act. Sqn. Ldr. L. W. MILLETT, D.F.C., R.A.F.V.R., No. 105 Sqn.—Since the award of the D.F.C., Sqn. Ldr. Millett has completed a large number of operational sorties. He participated in many sorties in support of the invasion forces before and after "D" day. More recently he has been engaged in attacks against important German targets. At all times he has maintained a high standard of skill. By his courage and determination, together with his ability to concentrate on the task in hand, he has materially contributed to the successful completion of many missions.

Act. Sqn. Ldr. T. L. PARRY, D.F.C., R.A.F.V.R., No. 158 Sqn.—Since the award of the D.F.C., Sqn. Ldr. Parry has completed many operational sorties. He has continued to maintain a high standard of operational efficiency in the flight he so ably commands and has set a magnificent example to all by his high courage, outstanding airmanship and devotion to duty. On one occasion this officer was captain of an aircraft detailed to attack an oil plant at Sterkrade. Intense anti-aircraft fire was encountered near Cologne and two engines of the aircraft were damaged. Although the aircraft was difficult to control, Sqn. Ldr. Parry, by superb airmanship, despite the damage, pressed on to his target and secured an excellent aiming point photograph. He then flew his aircraft safely back to an emergency landing ground in this country.

Act. Sqn. Ldr. F. RUSKELL, D.F.C., R.A.F.V.R., No. 109 Sqn.—After completing an arduous and varied first tour of operations, Sqn. Ldr. Ruskell has completed many further sorties on his second tour, including attacks against heavily defended industrial targets. Throughout, he has shown himself to be an outstanding successful navigator. Since the award of the D.F.C. he has continued to display courage, determination and devotion to duty of a very high order.

Flt. Lt. J. L. BIRCH, D.F.C., R.A.F.V.R., No. 156 Sqn.—This officer has always shown the utmost keenness for operational flying. Since the award of the D.F.C. he has participated in many further missions throughout which he has shown great courage and tenacity. His aircraft has been in combat with enemy fighters on many occasions and he has always proved himself to be a skilful and determined air gunner.

Flt. Lt. R. E. GARDINER, D.F.C., R.A.F.V.R., No. 625 Sqn.—Since the award of the D.F.C., Flt. Lt. Gardiner has participated in many operational missions against heavily defended and important targets. He has always shown himself to be an exceptionally skilful and cool navigator. On one occasion, during a daylight attack on Dortmund, his aircraft was severely damaged by anti-aircraft fire. The captain and mid-upper gunner were seriously injured. Undaunted by these hazardous circumstances, Flt. Lt. Gardiner skilfully navigated the aircraft safely back to base. This officer's unfailing courage and devotion to duty at all times have been most praiseworthy.

SERVICE AVIATION

THE CROSS-OVER: A prisoner-of-war painting R.A.F. roundels over the German cross on an Fw 190.

Distinguished Flying Cross

Act. Sqn. Ldr. J. J. M. BUTTON, R.A.A.F., No. 199 Sqn.
Act. Sqn. Ldr. L. J. PIASTO, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
Flt. Lt. H. G. MANLEY, R.A.A.F., No. 582 Sqn.
Flt. Lt. J. P. MOLONY, R.A.A.F., No. 105 Sqn.
Act. Flt. Lt. J. B. BENNETT, R.A.A.F., No. 78 Sqn.
Act. Flt. Lt. I. S. BUCHANAN, R.A.A.F., No. 15 Sqn.
Act. Flt. Lt. I. H. DERAMORE-DENVER, R.A.A.F., No. 156 Sqn.
Act. Flt. Lt. H. R. DUFF, R.A.A.F., No. 77 Sqn.
Act. Flt. Lt. H. F. HARRISON, R.A.A.F., No. 171 Sqn.
Act. Flt. Lt. S. B. MARTIN, R.A.A.F., No. 78 Sqn.
Act. Flt. Lt. B. D. MCCLENAUGHAN, R.A.A.F., No. 7 Sqn.
Act. Flt. Lt. J. E. MORRISON, R.A.A.F., No. 214 Sqn.
Act. Flt. Lt. K. A. RAWSON, R.A.A.F., No. 7 Sqn.
Act. Flt. Lt. R. H. SAMSON, R.A.A.F., No. 156 Sqn.
Act. Flt. Lt. R. D. WOODS, R.A.A.F., No. 90 Sqn.
F/O. R. G. BARRINGTON, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. J. H. BASKERVILLE, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. J. F. CAMERON, R.A.A.F., No. 105 Sqn.
F/O. O. W. DAWSON, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. P. R. GRAY-BUCHANAN, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
F/O. D. A. HENRY, R.A.A.F., No. 103 Sqn.
F/O. J. HONEYMAN, R.A.A.F., No. 100 Sqn.
F/O. L. W. MARSHALL, R.A.A.F., No. 15 Sqn.
F/O. W. H. MCEACHERN, R.A.A.F., No. 50 Sqn.
Capt. C. H. H. BARRY, S.A.A.F., No. 60 (S.A.A.F.) Sqn.
Wing Cdr. E. M. MITCHELL, R.C.A.F.
Act. Wing Cdr. R. L. BOLDUC, R.C.A.F., No. 429 (R.C.A.F.) Sqn.
Sqn. Ldr. T. M. JONES, R.C.A.F., No. 142 Sqn.
F/O. L. C. BOWEN, R.C.A.F., No. 426 (R.C.A.F.) Sqn.
F/O. H. G. BULLOCK, R.C.A.F., No. 101 Sqn.
F/O. W. A. CHMILAR, R.C.A.F., No. 156 Sqn.
F/O. C. L. COONNELL, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
F/O. N. E. CURRIE, R.C.A.F., No. 434 (R.C.A.F.) Sqn.
F/O. E. W. DORSEY, R.C.A.F., No. 158 Sqn.
F/O. D. R. ELLIS, R.C.A.F., No. 578 Sqn.
F/O. J. K. FERNIE, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
F/O. W. R. FOSTER, R.C.A.F., No. 10 Sqn.
F/O. G. R. FRANKLING, R.C.A.F. No. 403 (R.C.A.F.) Sqn.
F/O. G. H. FREE, R.C.A.F., No. 433 (R.C.A.F.) Sqn.
F/O. D. GOSLING, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
F/O. L. J. R. GREGOIRE, R.C.A.F., No. 153 Sqn.
F/O. J. N. GUSE, R.C.A.F., No. 420 (R.C.A.F.) Sqn.
F/O. A. W. HANSON, R.C.A.F., No. 424 (R.C.A.F.) Sqn.
F/O. J. B. HARRINGTON, R.C.A.F., No. No. 433 (R.C.A.F.) Sqn.
F/O. J. R. HARTLEY, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
F/O. A. D. HASTINGS, R.C.A.F., No. 90 Sqn.
F/O. F. L. HICKEY, R.C.A.F., No. 101 Sqn.
F/O C. K HORSNELL, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
F/O. A. P. HUCHALA, R.C.A.F., No. 431 (R.C.A.F.) Sqn.
F/O. R. D. IRVINE, R.C.A.F., No. 101 Sqn.
F/O. S. H. JACOBS, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
F/O. D. A. JOHNSON, R.C.A.F., No. 10 Sqn
F/O C. R. JONES, R.C.A.F., No. 428 (R.C.A.F.) Sqn.
F/O. H. J C. KEON, R.C.A.F., No. 90 Sqn.
F/O. D G. KING, R.C.A.F., No. 102 Sqn.
F/O. M. S. KYTE, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
F/O. J. H. J. LAREAU, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
Capt. K. F. D'ARCY, S.A.A.F., No. 72 Sqn.
F/O. J. BOWSKILL, R.A.F.V.R., No. 268 Sqn
P/O. J. BIRD, R.A.F.V.R., No. 72 Sqn.
Act. Sqn. Ldr. R. W. P. CAMERON, R.N.Z.A.F., No. 15 Sqn.
Flt. Lt. A. R. H BARTON, R.N.Z.A.F., No. 75 (N.Z.) Sqn.
Flt. Lt. A. G. CREAGH, R.N.Z.A.F., No. 75 (N.Z.) Sqn.
Flt. Lt. A. C. HARLEY, R.N.Z.A.F., No. 161 Sqn.
Act. Flt. Lt. L. F. LAWSON, R.N.Z.A.F., No. 35 Sqn.
F/O. D. W. ALLEN, R.N.Z.A.F., No. 105 Sqn.
P/O. A. KIDD, R.A.F.V.R., No. 578 Sqn.
P/O. A. A. SCHRODER, R.A.F.V.R., No. 10 Sqn.
P/O. J. S. THOMAS, R.A.F.V.R., No. 514 Sqn.
P/O. D. J. E. TURNER, R.A.F.V.R., No. 640 Sqn.
P/O. G. W. WALKER, R.A.F.V.R., No. 420 (R.C.A.F.) Sqn.

SERVICE AVIATION

F/O. J. H. MORAN, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. S. J. NOSWORTHY, R.A.A.F., No. 626 Sqn.
F/O. H. G. REDWOOD, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
F/O. P. J. A. ROTHWELL, R.A.A.F., No. 12 Sqn.
F/O. T. G. N. TRASK, R.A.A.F., No. 514 Sqn.
F/O. D. L. WRIGHT, R.A.A.F., No. 514 Sqn.
P/O. R. F. JONES, R.A.A.F., No. 51 Sqn.
P/O. J. D. MARLEY, R.A.A.F., No. 467 (R.A.A.F.) Sqn.
W/O. (now P/O.) P. E. KIELY, R.A.A.F., No. 149 Sqn.
W/O. (now P/O.) G. L. SIM, R.A.A.F., No. 15 Sqn.
F/O. B. LE V. MARTIN, R.C.A.F., No. 408 (R.C.A.F.) Sqn.
F/O. A. P. MCKILLOP, R.C.A.F., No. 419 (R.C.A.F.) Sqn.
F/O. C. D. RAE, R.C.A.F., No. 434 R.C.A.F.) Sqn.
F/O. J. L. R. G. SIMARD, R.C.A.F., No. 425 (R.C.A.F.) Sqn.
F/O. J. S. WARD, R.C.A.F., No. 77 Sqn.
F/O. M. A. WESTBY, R.C.A.F., No. 195 Sqn.
P/O. H. C. LAYTON, R.C.A.F., No. 158 Sqn.
P/O. E. A. MOYNES, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
P/O. J. C. J. SCARF, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
P/O. J. VINE, R.C.A.F., No. 415 (R.C.A.F.) Sqn.
W/O. M. D. MACRITCHIE, R.C.A.F., No. 77 Sqn.
W/O.2 A. PUCHALSKI, R.C.A.F., No. 77 Sqn.
F/O. W. J. OLLEY, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. A. E. PRESTON, R.A.A.F., No. 192 Sqn.
F/O. B. B. ROBINSON, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
Flt. Lt. R. C. GARDNER, R.A.A.F., No 681 Sqn.
P/O. T. W. CHEEVERS, R.A.A.F., No. 681 Sqn.
F/O. A. H. RYAN, R.A.A.F., No. 158 Sqn.
F/O. R. L. SIMPSON, R.A.A.F., No. 622 Sqn.
F/O. D. C. SMITH, R.A.A.F., No. 576 Sqn.
F/O. J. O. WEEKES, R.A.A.F., No 433 (R.C.A.F.) Sqn.
F/O. R. H. WHITE, R.A.A.F., No. 7 Sqn.
P/O. D. H. CONNORS, R.A.A.F., No. 35 Sqn.
P/O. D. M. EASTERBROOK, R.A.A.F., No. 192 Sqn.
P/O. L. V. DREDGE, R.A.A.F., No. 170 Sqn.
P/O. R. F. GODWIN, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
P/O. F. S. W. GUBBINS, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
F/O. H. D. A. HERZ, R.A.A.F., No. 218 Sqn.
P/O. H. R. MARTIN, R.A.A.F., No. 100 Sqn.
P/O. R. E. MULRONEY, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
P/O. F. S. SMITH, R.A.A.F., No. 460 (R.A.A.F.) Sqn.
P/O. A. J. VIAL, R.A.A.F., No. 35 Sqn.
P/O. R. A. WHEATON, R.A.A.F., No. 582 Sqn.
P/O. A. F. WILLINGTON, R.A.A.F., No. 466 (R.A.A.F.) Sqn.
P/O. T. D. WISE, R.A.A.F., No. 102 Sqn.
W/O. R. R. BANKS, R.A.A.F., No. 15 Sqn.
W/O. G. C. CORRAN, R.A.A.F., No. 582 Sqn.
W/O. (now P/O.) H. R. S. SULLIVAN, R.A.A.F., No. 635 Sqn.
F/O. A. E. TAYLOR, R.A.F.V.R., No. 29 Sqn.
P/O. T. A. CARSON, R.A.F.V.R., No. 19 Sqn.
W/O. (now P/O.) A. R. CRESSWELL, R.N.Z.A.F.
W/O. W. J. GORDON, R.A.F.V.R., No. 29 Sqn.
Flt. Lt. D. CLARE, R.A.F.V.R., No. 524 Sqn.
Flt. Lt. D. A. DREW, R.A.F.V.R., No. 64 Sqn.
Flt. Lt. E. D. EYLES, R.A.F.V.R., No. 96 Sqn.
Flt. Lt. J. M. W. LLOYD, R.A.F.V.R., No. 65 Sqn.
Flt. Lt. D. R. STEPHENS, R.A.F., No. 122 Sqn.

THE KING has been graciously pleased to approve the following awards:—

Air Force Cross

Flt. Lt. H. G. BARKER, R.A.F.V.R.
Flt. Lt. R. W. BATES, R.A.F.V.R.
Flt. Lt. J. H. BREARLEY, R.A.F.V.R.
Flt. Lt. P. F. BROOKER, R.A.F.V.R.
Flt. Lt. N. BUCHANNAN, R.A.F.V.R.
Flt. Lt. M. E. BURNHAM, R.A.F.V.R.
Flt. Lt. A. L. CALDERWOOD, R.A.F.V.R.
Flt. Lt. A. CODY, D.F.C., D.F.M., R.A.F.
Flt. Lt. P. E. DANIELS, R.A.F.V.R.
Flt. Lt. J. DAVIS, R.A.F.
Flt. Lt. K. S. DEWHURST, R.A.F.
Flt. Lt. D. T. DONAN, R.A.F.V.R.
Flt. Lt. J. C. EDENS, R.A.F.V.R.
Flt. Lt. L. G. FAULKNER, R.A.F.
Flt. Lt. J. FEENEY, R.A.F.V.R.
Flt. Lt. F. H. GOODACRE, R.A.F.
Flt. Lt. G. GRAHAM-SMITH, R.A.F.V.R.
Flt. Lt. F. C. GUILMANT, R.A.F.V.R.
Flt. Lt. H. H. HALL, R.A.F.
Flt. Lt. A. K. INGLE, R.A.F.V.R.
Flt. Lt. H. JACOBS, D.F.C., R.A.F.V.R.
Flt. Lt. S. A. D. LANGSTON, R.A.F.V.R.
Flt. Lt. W. L. MCILWRAITH, R.A.F.V.R.
Flt. Lt. L. B. NOYES, R.A.F.
Flt. Lt. D. PALIN, R.A.F.V.R.
Flt. Lt. W. E. RANDALL, D.F.C., R.A.F.V.R.
Flt. Lt. R. E. B. SARGENT, R.A.F.V.R.
Flt. Lt. F. H. SNELL, R.A.F.V.R.
Flt. Lt. J. M. TAYLOR, R.A.F.V.R.
Flt. Lt. A. E. TILLEY, R.A.F.V.R.
Flt. Lt. R. WALTON, R.A.F.V.R.
Flt. Lt. B. J. WATSON, R.A.F.V.R.
Flt. Lt. R. H. WELCH, R.A.F.V.R.
Flt. Lt. G. H. WOOD, R.A.F.V.R.
Act. Flt. Lt. A. W. BEDFORD, R.A.F.V.R.
Act. Flt. Lt. P. E. DANIELS, R.A.F.V.R.
Act. Flt. Lt. K. EGGLESTON, D.F.C., R.A.F.V.R.
Act. Flt. Lt. K. E. WALTERS, R.A.F.V.R.
F/O. R. B. BELDERSON, R.A.F.V.R.
F/O. W. D. BREARLEY, R.A.F.V.R.
F/O. E. DRING, R.A.F.V.R.
F/O. A. A. GARDINER, R.A.F.V.R.
F/O. F. J. LEWIS, R.A.F.
P/O. D. MACKENZIE, R.A.F.V.R.
W/O. W. J. ATKINSON, R.A.F.V.R.
W/O. F. R. BEALING, R.A.F.
W/O. C. C. H. DASH, R.A.F.V.R.
W/O. G. HORSHAM, R.A.F.
W/O. E. J. HUGHES, R.A.F.V.R.
W/O. A. R. MARTIN, R.A.F.V.R.
W/O. W. H. L. MILNER, R.A.F.V.R.
W/O. J. G. TAIT, R.A.F.V.R.
Act. Lt. Cdr. D. R. ROBERTSON, R.N.V.R.
Flt. Lt. E. O. LANE, D.F.C., R.A.A.F.
F/O. G. MADDERN, R.A.A.F.
P/O. J. A. FALCONER, R.A.A.F.
Sqn. Ldr. E. N. TOWNSEND, R.C.A.F.
Flt. Lt. A. L. BROWN, D.F.C., R.C.A.F.
Flt. Lt. W. H. MCDONALD, R.C.A.F.
Flt. Lt. W. L. MABB, R.C.A.F.
Flt. Lt. L. A. MOORE, D.F.C., R.C.A.F.
F/O. C. W. CRAWFORD, R.C.A.F.
Flt. Lt. E. K. BUCHANAN, R.N.Z.A.F.
Flt. Lt. J. P. FORD, R.N.Z.A.F.
P/O. J. H. MOORE, R.N.Z.A.F.
Capt G. T. MACROBERT, S.A.A.F.
Capt. C. P. van de M. STRAUSS, S.A.A.F.
Capt. H. C. WARREN, S.A.A.F.

THE KING has been graciously pleased to approve the following awards in recognition of gallantry and devotion to duty in the execution of air operations:—

Distinguished Flying Medal

Flt. Sgts. D. R. PYNE, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
Flt. Sgt. W. R. READ, R.C.A.F., No. 608 Sqn.
Flt. Sgts. C. M. ROBINSON, R.C.A.F., No. 405 (R.C.A.F.) Sqn.
Flt. Sgts. R. W. EDMOND, R.C.A.F., No. 166 Sqn.
Flt. Sgts. H. I. SCOTT, R.C.A.F., No. 166 Sqn.
Flt. Sgt. W. J. DEMPSTER (later W/O), R.C.A.F., No. 7 Sqn.
Flt. Sgt. D. A. MILLS, R.A.F.V.R., No. 156 Sqn. (since deceased).
Flt. Sgt. J. B. NELSON, R.A.F.V.R., No. 357 Sqn.
Flt. Sgt. R. W. MORLEY, R.A.F.V.R., No. 49 Sqn.
Flt. Sgt. I. C. REDFEARN, R.A.F., No. 35 Sqn. (since deceased).
Flt. Sgt. D. F. TAMS, R.A.F.V.R., No. 502 Sqn.
Flt. Sgt. G. E. TUCKER, R.A.F.V.R., No. 356 Sqn.
Flt. Sgt. J. WORSDALE, R.A.F.V.R., No. 97 Sqn.
Act. Flt. Sgt. (later P/O.) G. A. JOHNSON, R.A.F.V.R., No. 97 Sqn.
Act. Flt. Sgt. (later P/O.) R. L. ROBINSON, R.A.F.V.R., No. 35 Sqn.
Flt. Sgt. (now P/O.) J. J. STURGES, R.A.A.F., No. 77 Sqn.
Flt. Sgt. R. TAYLOR, R.A.A.F., No. 576 Sqn.
Flt. Sgt. K. N. HEILBRONN, R.A.A.F., No. 357 Sqn.

Badge of No. 283 Squadron, R.A.F. "Attende et Vigila" (Be Alert and on Guard).

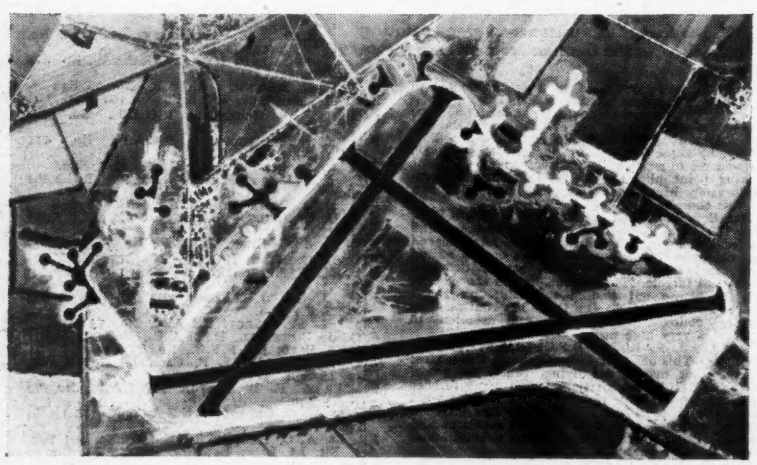
THE KING has been graciously pleased to approve the following awards

B.E.M. (Mil.)

L.A/C. R. N. GARRED, R.A.F.V.R., and L.A/C. S. W. READ, R.A.F.V.R.—These airmen were employed continuously on minefield clearance at an airfield for a period of six weeks in 1944. They have been of the utmost assistance to the N.C.O. in charge of the section in his work of breaching minefields and locating and neutralising mines. Both have been outstanding amongst about 25 airmen below the rank of corporal who have been engaged on the minefield and they have never hesitated to perform work far beyond that which could be expected of them in view of their classification and training. They have shown keenness and courage on work of a hazardous nature and have contributed much to the success which has been achieved.

L.A/C. P. CROWLEY, R.A.F.V.R., R.A.F. Regiment.—After the explosion of a bomb in January, 1945, this airman, assisted by a flight sergeant, crawled beneath a huge piece of reinforced concrete which had fallen on top of an officer. The concrete was precariously supported by loose bricks and rubble and was in imminent danger of crushing L.A/C. Crowley as he worked beneath it. Failing to extricate the officer at the first attempt, this airman made a further effort by burrowing under the concrete from the opposite side. The officer was later found to have died whilst the rescue attempts were being made and was extricated by a heavy rescue party, who cut through the concrete. L.A/C. Crowley made persistent and gallant efforts to rescue the officer although he had set himself an impossible task. His services were outstanding, even amongst other acts of gallantry displayed in connection with this incident.

L.A/C. F. F. SPRULES, R.A.F.V.R.—In January, 1945, a Fortress aircraft, in attempting to land at an airfield, crashed into a hangar. L.A/C. Sprules ran to the scene, where he assisted seven members of the crew to escape from the furiously burning aircraft. Although the crew warned him that the aircraft was loaded with bombs, he continued to help the injured. The bomb load (3,800 lb.) exploded about five minutes after his arrival, showering debris around him, but his only thought was for the men who needed medical attention. He took some of the casualties to the sick quarters in a lorry which drove up to the scene after the explosion had occurred, afterwards returning to the scene of the crash to give any further help which might be required. Until the arrival of many helpers after the explosion, L.A/C. Sprules had worked alone with courage, coolness and a complete disregard for his own safety. He was fully aware that a devastating explosion was likely to occur. He was shocked by the concussion, but continued to render all the assistance he could in spite of ammunition which was exploding around him. Had it not been for his efforts it is probable that the fatalities would have been more numerous. In fact, only two of the crew lost their lives.



BUILD, LEASE AND LEND: To accommodate the U.S.A.A.F. in Britain, airfields to the cost of £645,000,000 were constructed. Of this sum £605,000,000 was borne by Britain. This picture of Snetterton Heath, in East Anglia, shows a typical airfield with three runways, the longest 2,000 yds.

Roll of Honour

Casualty Communiqué No. 521.

THE Air Ministry regrets to announce the following casualties on various dates. The next-of-kin have been informed. Casualties "in action" are due to flying operations against the enemy; "on active service" includes ground casualties due to enemy action, non-operational flying casualties, fatal accidents and natural deaths.

Of these 159 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—Flt. Lt. L. W. Basan; F/O. D. D'A. Batchelor; Flt. Sgt. F. R. Blight; Sgt. P. G. Cannon; W/O. F. Heard; F/O. S. E. Huygens; Flt. Lt. G. S. Johnson, D.F.C.; Sgt. D. S. Lennie; F/O. A. J. Norton; F/O. J. J. Nunn; Sgt. J. Shield; Flt. Sgt. L. E. Twigg; P/O. E. G. Warrington; Sgt. D. F. Wilson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. E. L. Bartley; Wing Cdr. J. M. Bryan, D.F.C.; Sgt. J. Corless; F/O. J. A. Inglis; F/O. C. R. Pollard.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. J. Balmer; Sgt. C. W. Banfield; F/O. D. A. Burden; Flt. Lt. F. C. W. Clement; Flt. Sgt. G. F. Clulow; Sgt. R. W. Collins; Sgt. R. N. P. Critchlow; P/O. R. C. A. Crouch; Sgt. W. H. Dean; Flt. Sgt. N. Dixon; P/O. R. W. Egleton; F/O. E. McG. Fletcher; Sgt. W. V. Ford; F/O. G. Fraser; Sgt. S. A. G. Gardner; Flt. Sgt. R. E. Greenfield; Sgt. J. Grier; Flt. Sgt. F. W. Halsey; P/O. D. S. Heys; Sgt. P. Hughes; F/O. J. H. Ingram; Flt. Lt. E. H. Jaffreys, D.F.C.; F/O. R. H. Johnson; Sgt. S. Jones; Sgt. W. D. Jones; Sgt. F. Keighley; Sgt. D. M. Lees; Sgt. P. J. Lynch; Sgt. A. R. Newell; Sgt. J. Norgrove; Flt. Sgt. J. Palmer; Sgt. A. S. Pitfield; P/O. H. W. Platten; Sgt. R. D. Potter; Sgt. T. Powell; Sgt. W. E. Sinclair; Sgt. A. M. Stickells; Sgt. W. Surgey; Sgt. F. Tough; Sgt. T. H. McCaffrey; Sgt. E. McCully; Sgt. D. T. Mackintosh; Sgt. J. M. McLachlan; P/O. T. G. Marsh; Sgt. J. A. May; Sgt. D. V. Menell; Sgt. D. Watson; F/O. W. B. Wilkinson; F/O. E. A. Williams.

WOUNDED OR INJURED IN ACTION.—W/O. W. H. Ewan; F/O. H. H. Holdsworth; Flt. Sgt. D. G. Kingsland.

MISSING.—P/O. K. C. Allan; F/O. S. R. Angill; P/O. R. W. Ashman; P/O. A. C. Aston; W/O. R. J. Ball; W/O. A. C. N. Bates; Wing Cdr. B. Bell; Sgt. D. B. Boyce; Flt. Lt. W. B. Brooks; Flt. Sgt. P. G. Buckland; Flt. Lt. N. Burrows; Sgt. B. J. B. Carr; Sgt. R. J. Carrott; Flt. Sgt. W. J. Carthew; Sgt. K. G. Cheshire; P/O. E. M. Chetwynd-Stapylton; Sgt. D. McB. Crowe; W/O. E. A. Daden; Flt. Sgt. J. R. Downing; Sgt. J. G. Evans; Sgt. J. Finlayson; P/O. D. P. M. Finnigan; Flt. Lt. L. G. Fowler, D.F.C.; Sgt. R. L. Gibbs; F/O. B. W. Golden; Flt. Sgt. R. A. Gould; Sgt. R. Gray; Flt. Sgt. A. E. Grimsdell; Sgt. G. Hancock; Sgt. W. M. Haragan; W/O. M. Harding; Sgt. S. F. Heaven; Sgt. J. Holloway; Sgt. M. J. Husband; Flt. Sgt. G. J. E. Jennings; F/O. A. M. Jones, D.F.M.; Sgt. F. G. Jones; Flt. Sgt. S. L. Jones; Flt. Lt. H. Knight; W/O. W. Lorains; Flt. Lt. D. E. A. Luger; Flt. Sgt. J. Maltby; P/O. B. Martin; Flt. Sgt. E. J. Maslin; F/O. G. E. Mercer; Sgt. R. D. Mitcheson; Sgt. E. D. Mobberley; Flt. Sgt. W. F. E. Mole; Sgt. R. Monk; F/O. F. C. Morgan; Flt. Sgt. E. Morris; F/O. N. S. Morton; Flt. Sgt. D. B. Newman; Sgt. S. J. A. Pegram; Sgt. A. S. Pitt; Flt. Sgt. T. W. Pollard; Flt. Sgt. R. E. Price; Flt. Sgt. C. F. Purnell; F/O. R. G. Savory; Sgt. W. J. R. Scott; F/O. J. M. Shortt; Flt. Lt. T. C. B. Smith; Sqn. Ldr. A. N. Spear, D.F.M.; Flt. Sgt. J. K. Spedding; Sgt. W. Stephens; Flt. Lt. J. G. Strauss; P/O. D. F. Tapson; Sgt. G. C. Toes; P/O. R. W. Towell; Sgt. E. A. E. Tucker; Sgt. T. W. H. Usher; Flt. Sgt. L. B. Waller; Flt. Sgt. D. W. Webb; Flt. Sgt. R. Wellington; Flt. Sgt. A. E. Whitams; Flt. Sgt. L. R. Willis; Flt. Lt. F. R. Woodger; Sgt. B. F. Woods; Flt. Lt. J. W. Woolfries.

KILLED ON ACTIVE SERVICE.—F/O. A. J. Atkinson; W/O. G. W. Barling; Sgt. J. R. Birch; F/O. L. A. Birkett; Flt. Sgt. D. W. Brooks; F/O. A. H. Bulmer; Wing Cdr. C. N. Carpenter; P/O. G. D. Cribbes; F/O. A. S. Davidson; A/C.2 R. W. French; Flt. Lt. R. C. Ferguson; Sgt. W. T. Gothard; Sgt. A. Holland; F/O. B. W. Hutchins; Sgt. C. Jackson; Sgt. E. Kershaw; Flt. Lt. D. S. Lake, D.F.M.; F/O. D. S. McGregor; Sqn. Ldr. W. H. Maguire, D.F.C.; W/O. F. Needham; W/O. D. R. Newbury; Flt. Lt. R. H. Phillips; Sgt. B. A. T. Rattenbury; Sgt. G. E. C. Richards; Flt. Sgt. F. A. Russell; Flt. Lt. F. W. Silvester; F/O. A. L. Tomlinson; Flt. Sgt. J. W. Tomlinson; Flt. Lt. J. F. Warren.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. A. S. Adshead; Flt. Sgt. R. W. Henderson; W/O. H. Johnston, D.F.M.; Cpl. J. G. Stewart; A/C.1 P. G. Sykes; Flt. Sgt. N. W. Thomson.

PREVIOUSLY REPORTED MISSING, NOW REPORTED KILLED ON ACTIVE SERVICE.—L.A/C. G. F. Poole.

ON PARADE: Air Marshal Sir Guy Garrod inspects a detachment of R.A.F. Regiment of the Desert Air Force. On the extreme left is Air Vice-Marshal R. M. Foster, A.O.C., D.A.F.

WOUNDED OR INJURED ON ACTIVE SERVICE.—L.A/C. W. J. Cartwright; L.A/C. A. Collier; Cpl. R. W. Dalzell; A/C.1 J. Gill; L.A/C. G. W. F. Handy; Cpl. B. C. S. Harvey; A/C.2 L. Hughes; A/C.1 P. C. McLarty; A/C.2 G. E. Mann; L.A/C. T. W. Morris; L.A/C. D. B. Redrup; Cpl. R. C. M. Robertson; Cpl. E. Salisbury; Cpl. E. Sheppard; Cpl. R. J. Taylor; L.A/C. J. H. Wheeler.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Flt. Sgt. R. Gent; A/C.2 P. C. Johns; Flt. Lt. W. Waddell.

DIED ON ACTIVE SERVICE.—Flt. Sgt. T. B. B. Barnett; Sgt. A. R. Baxter; L.A/C. A. Burton; Flt. Sgt. W. H. Clark; L.A/C. C. C. Cough; Cpl. R. Dalton; Flt. Lt. S. M. Dodd; L.A/C. J. G. Grant; L.A/C. T. B. Graves; L.A/C. S. Jones; L.A/C. W. MacR. MacLeod; L.A/C. B. Marshall; A/C.2 R. A. Mures; Cpl. E. A. J. Raven; L.A/C. G. T. Rea; Cpl. R. C. Warner.

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—Sec./O. D. Shaw.

Royal Australian Air Force

KILLED IN ACTION.—Flt. Sgt. R. H. Cheatle.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. R. F. Culliford; P/O. A. E. Oberg.

WOUNDED OR INJURED IN ACTION.—F/O. T. A. McLelland.

MISSING, BELIEVED KILLED IN ACTION.—W/O. M. J. Mathers.

MISSING.—P/O. J. D. Blackshaw; Flt. Sgt. G. S. M. Fowler; Flt. Sgt. R. Y. French; P/O. J. C. Hartley; F/O. D. N. Kehoe; Flt. Lt. R. C. McColl; P/O. L. L. MacDonald; W/O. D. E. Mutimer; Flt. Lt. J. J. Osmond, D.F.C.; W/O. G. A. Perry, D.F.M.; Flt. Lt. A. J. Rate; P/O. V. J. Trunk; Flt. Sgt. L. S. Tucker; F/O. A. W. Wolk.

KILLED ON ACTIVE SERVICE.—F/O. A. L. Roe.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. H. C. Smalley.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O. M. Baran; P/O. J. E. R. Bowering; F/O. S. W. Cook; F/O. H. A. Evans; F/O. J. M. Finnie; Sqn. Ldr. N. R. Fowlow, D.F.C.; Flt. Lt. S. V. Garside; P/O. J. R. L. N. Guillot; P/O. T. G. Hart; Flt. Sgt. E. D. Kidd; Flt. Sgt. E. N. Kullberg; W/O. R. McMillan; F/O. L. S. McMurchy; P/O. F. J. Schmidt; W/O. D. J. E. Schmitz; F/O. W. S. Shea; F/O. A. G. Smith; F/O. E. S. Smith; P/O. G. W. Taylor; P/O. C. S. Thompson; P/O. T. W. Tuttle; P/O. G. F. Vinett; Sgt. C. C. White; P/O. S. A. Wilson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—P/O. D. J. Applin; Flt. Lt. E. A. Armstrong; W/O. R. B. Beach; P/O. F. Beales; Flt. Lt. F. C. Bertelsen; P/O. N. A. Boucher; F/O. D. N. Cameron; P/O. J. J. B. Cardinal; P/O. G. W. Carruthers; F/O. J. W. Collyer; P/O. V. J. Cownden; P/O. A. M. Dewitt; P/O. W. L. Doran; P/O. J. T. G. G. Dufour; W/O. L. F. Dutton; P/O. C. I. Elsley; P/O. J. H. Ferguson; P/O. S. W. Follows; P/O. R. W. Francis; F/O. D. Fuller; P/O. R. C. Gallaugher; P/O. M. E. Gates; P/O. D. G. Goodfellow; W/O. G. H. Hobson; Flt. Lt. J. Hodgson; Flt. Sgt. R. A. Jack; F/O. H. R. Jones; F/O. W. M. Lacey; P/O. M. R. Larkin; F/O. G. R. Lauder; P/O. F. W. Layton; P/O. R. G. Lemky; P/O. W. D. Lillico; F/O. E. R. Lowe; P/O. N. A. Lumgair; P/O. V. N. Lunney; Flt. Lt. S. C. McDonald; P/O. I. N. McInnis; F/O. J. A. McIntyre; P/O. M. McLear; F/O. D. J. McMullen; F/O. C. R. McOrmond; P/O. F. E. McQueen; P/O. J. P. Merritt; P/O. M. Morrison; F/O. N. G. Nahu; Flt. Sgt. G. L. Nordbye; F/O. D. B. Norton; Flt. Sgt. E. L. O'Neill; F/O. W. E. Parsons; F/O. R. N. Pole; P/O. R. W. Rathwell; F/O. W. V. F. Reid; F/O. J. L. Ritchie; P/O. D. M. Robson; P/O. C. V. Ross; W/O. G. A. Schwerdfeger; P/O. B. C. Scobie; P/O. D. T. Serviss; P/O. J. E. Shepherd; P/O. P. S. Smith; P/O. G. W. Snow; F/O. G. E. Stockdale; P/O. A. F. Taillon; Flt. Sgt. D. A. Taylor; P/O. J. H. Thornton; P/O. G. R. Thorpe; F/O. C. E. Tindall; P/O. G. M. Weaver; F/O. R. N. Wilson.

DIED OF WOUNDS OR INJURIES RECEIVED IN ACTION.—F/O. W. A. Brodie.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED ON ACTIVE SERVICE, NOW PRESUMED KILLED ON ACTIVE SERVICE.—F/O. J. M. Rickard.

Royal New Zealand Air Force

KILLED IN ACTION.—Flt. Lt. G. K. Malcolmson; F/O. J. P. Robertson.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. H. D. Parker.

MISSING.—W/O. L. J. Bennett; P/O. B. L. Butler; W/O. F. H. Dix, Sqn. Ldr. D. J. V. Henry; Flt. Sgt. F. R. Olds.

South African Air Force

KILLED IN ACTION.—Lt. C. W. McGregor.

MISSING.—Lt. Bodley; Capt. A. Lens; Lt. J. G. McLelland; Lt. St. L. G. Potgieter.

KILLED ON ACTIVE SERVICE.—Lt. F. E. Balck.

DIED ON ACTIVE SERVICE.—Cpl. J. Wright.

PREVIOUSLY REPORTED MISSING, NOW REPORTED PRISONER OF WAR.—W/O. H. J. Brown.

Casualty Communique No. 522

Of the names in this list 149 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—L.A/C. F. Bainbridge; L.A/C. R. G. Baldry; L.A/C. S. A. Bamber; Cpl. E. B. Chadd; Cpl. D. Cooper; F/O. D. N. A. Cooper; F/O. E. W. Curtis; L.A/C. W. D. Davies; F/O. P. J. Day; Sgt. G. C. Dickinson; Sgt. H. Evans; L.A/C. T. H. Floody; Sgt. J. L. Fryer; Cpl. C. Gibson; Flt. Lt. J. B. Goodwin; Sgt. J. Gregory; Sgt. J. W. Hall; Flt. Sgt. M. E. Hathaway; Flt. Sgt. R. J. Hill; Sgt. J. Holding; W/O. W. J. Howson; Cpl. G. E. N. R. Lee; Flt. Lt. G. Y. G. Lloyd; Sgt. J. Malcolm; F/O. H. R. Mock; P/O. I. A. S. Moore; Sgt. J. F. Moyle; L.A/C. J. Neale; L.A/C. W. Nerden; F/O. R. G. Nye; F/O. K. W. Oddy; Flt. Sgt. D. H. Phillips; F/O. F. H. Pickard; W/O. O. G. Points; P/O. C. A. Rattray; L.A/C. R. Smith; L.A/C. G. Stevens; Sgt. C. Stuart; Sgt. R. Taylor; P/O. E. H. Thompson; Flt. Sgt. J. Webb; L.A/C. A. E. D. Wilkes; L.A/C. G. Wilson; Flt. Lt. T. N. G. Winning; Flt. Sgt. B. Woodhouse.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. J. T. Dunn; F/O. J. D. Eglen; F/O. P. H. Greenburgh; Flt. Lt. J. B. L. Jones; W/O. W. J. Knill; Sqn. Ldr. E. W. Lindsay; F/O. A. Oakes; Flt. Sgt. J. F. Philips; F/O.

Badge of Royal Air Force Station, Luga. "Mitjar Qatt Mirbuh" (An Airfield Never Beaten).

SERVICE AVIATION

C. W. Rumley; Sgt. J. F. G. Stebbings; P/O. C. C. Sykes.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. K. Anderson; Sgt. A. J. Armstrong; Sgt. R. J. Asplen; Sgt. P. Atha; Flt. Sgt. R. W. Beach; P/O. L. B. Benson; Flt. Sgt. E. Berwick; Sgt. F. G. S. Bilney; F/O. R. W. Blaydon, D.F.M.; W/O. R. J. Bonar; Sgt. H. J. Bowen; Sgt. W. Bowers; Flt. Sgt. J. A. Bowler; P/O. K. N. Bradford; P/O. D. Bray; Sgt. C. A. Brooks; Sgt. E. W. Brown; Flt. Sgt. J. T. Brown; Flt. Sgt. P. Brunton; Flt. Lt. J. A. Bulcraig, D.F.M.; Sgt. A. E. Bullivant; Flt. Sgt. G. Cameron; Sgt. C. McK. Campbell; Flt. Sgt. R. G. Campbell; P/O. D. H. Carr; Flt. Sgt. W. H. Carr; Flt. Sgt. J. W. Clarke; Sgt. G. R. Collins; Sgt. J. Coup; Sgt. A. W. Cracknell; P/O. K. L. Curtis; W/O. P. Daley; P/O. H. N. Davies; Sgt. P. E. Davies; F/O. R. W. Densham; Flt. Sgt. A. H. Dickel; F/O. K. Dutton; Sgt. W. F. Edwards; Sgt. J. E. Ellis; Flt. Sgt. K. A. Fairclough; Flt. Sgt. R. Fairplay; Sgt. D. J. Findlay; Flt. Sgt. D. Francis; Sgt. K. G. Francis; Sgt. F. T. Fuller; Flt. Sgt. N. L. E. Gale, D.F.M.; W/O. W. Gaughran; Flt. Sgt. T. N. Gilchrist; Sgt. J. D. Goskirk; Flt. Sgt. R. Greig; Flt. Lt. F. Haigh; F/O. D. Hargreaves; W/O. E. J. Hawker; Flt. Sgt. W. Hewitt; Flt. Sgt. R. Hinde; F/O. F. R. Hocken; Sgt. W. Holmes; Sgt. T. J. Hynes; Sgt. H. Jackson; Sgt. R. E. James; Sgt. W. Jenkins; Sgt. H. John; Flt. Sgt. W. F. Johnson; Flt. Sgt. H. G. Jones; Sgt. W. Kirkland; Flt. Sgt. W. A. Lampkin; Flt. Lt. R. D. Langton; P/O. J. Laurens; Sgt E. Lee; Sgt. E. R. Lee; Sgt. T. B. Liddle; Sgt. W. Longden; Sgt. T. Loughlin; Flt. Sgt. J. A. McClean; F/O. I. E. Macmaster; Sgt. L. Martin; P/O. W. J. Martyn; Flt. Lt. A. E. A. Matthews, D.F.C.; Sgt. P. Newman; Sgt. L. H. Nightingale; P/O. D. L. Northover; Sgt. K. D. Oclee, Sgt. D. A. Page; Sgt. H. F. Page; Sgt. J. C. Patten; Flt. Sgt. C. Peacock; F/O. W. Pearce; Sgt. R. Pennykidd; Flt. Sgt. L. J. Phillips; P/O. E. Pickin; Flt. Sgt. V. G. Raymond; Flt. Sgt. L. E. Read; P/O. M. C. Reid; F/O. G. L. Reynolds; Sgt. J. F. Richardson; F/O. E. C. Robson; Sgt. D. Savage; Sgt. S. Smith; Flt Sgt. M. M. Stembridge; Sgt D. H. Stoneham, P/O. J. Sutton; Sgt. S. W. Tolley; F/O. D. G. Turner; F/O. T. J. R. Turner; Flt. Sgt. S. J. Upton; Sgt. R. Walmsley; Sgt. C. Webb; W/O. A. Western; Flt. Sgt. H. Whiteley; Sgt. G. H Witney; Sgt. A. Wood; Sgt. C. H. Wright; Flt. Sgt. L. Young.

MISSING, BELIEVED KILLED IN ACTION.—Sgt. A. T. Dobson.

MISSING.—Sgt. K. C. R. Alder; F/O. D. S. Angier; Flt. Sgt. J. C. R. Bignell; Flt. Sgt. A. L. Bragg; Flt. Lt. J. P. Braund; Sgt. A. P. Bulger; Sgt. A. Burnett; Sgt. W. Burns; Flt. Sgt. F. D. Byrne; Sgt. W. A. A. Clark; Flt. Sgt. M. C. Eddleston; Flt. Lt. G. P. Elliott; W/O. A. M. Elston; Flt. Lt. R. H. Fossett, A.F.C.; Sgt. S. Foster; F/O. W. P. Fryer; Sgt. T. H. Fullwood; Sgt. G. R. Gilfillan; Sgt. C. Glatt; Sgt. J. D. Hall; W/O. J. Hartley; Sgt. E. M. Holliday; Sgt. G. A. Hubbard; F/O. R. A. Hudson; Flt. Sgt. A. E. S. Kiff; Sgt. R. L. Leforte, Flt. Sgt. S. Lock; Flt. Sgt. J. L. Longhurst; Sgt H. Mariner; F/O. J. Middleton; Sgt. M. Moore; Sgt. J. Murphy; Flt. Sgt. T. P. Nathaniel; P/O. F. T. J. Nicholls; Flt. Sgt. R. E. Nicholas; Sgt. A. H. Pettman; F/O. A. R. Pewsey; F/O. K. S. Porter; F/O. J. Ritchie; Sgt. B. Robinson; F/O. C. F. Royds; Sgt. F. A. Rushworth; Sgt. R. E. Russell; P/O. L. W. Sellman; Sgt. F. G. A. Shaboe; Flt. Sgt. A. G. Simmons; Flt. Sgt. A. E. Smith; Sgt. C. D. Spruce; Flt. Sgt. E. V. Staples; Sgt. A. C. St. Leger; F/O. R. M. M. Strattan; Sgt. J. Swain; Sgt. W. H. Swan; W/O. R. Thomson; Sgt. G. Turner; Sgt. H. J. Vidamour; Flt. Sgt. W. B. Warr; Sgt. D. S. Watson; Sgt. H. C. Whaites; F/O. A. Wood; Flt. Sgt. D. Wood.

KILLED ON ACTIVE SERVICE.—F/O D. M. Beagley; Flt Lt J. V. Billett; F/O. L. C. Davies; Flt. Lt. L. A. Hudson; Flt. Sgt. F. W. Stroud, D.F.M.; Sgt. J. Waters; Flt. Lt. R. O. Webster.

WOUNDED OR INJURED ON ACTIVE SERVICE.—Sgt. H. J. H. Beaumont; F/O. A. D. Denaro.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—F/O. O. D. R. Gould; Sqn. Ldr. F. P. Grant

Women's Auxiliary Air Force

DIED ON ACTIVE SERVICE.—A/CW.1 M. Evans.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—P/O G. A. A'Court; F/O. K. E. Archay; F/O. F. J. Clubb; P/O. E. V. Dearnaley, D.F.C.; Flt. Sgt. R. McP. Hill; F/O. W. Kirk; W/O A. F. Mayne; Flt. Sgt. L. W. Weeden; P/O. P. B. White.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Lt. L. R. Brine; Flt. Sgt. R. J. Carlill; Flt. Sgt. D. G. Cranston; W/O. W. N. English; W/O. T. Harrison; F/O. F. S. Lamble; Flt. Sgt. V. D. Luton; Flt. Sgt. S. J. Saligari; Flt. Sgt. D. M. Shelton; Flt. Sgt. G. H. Williamson.

MISSING.—W/O. J. Begg; Wing Cdr. J. K. Douglas, D.F.C., A.F.C.; Flt. Lt. R. K. Gibson; Flt. Sgt R. Hardy; F/O. H. T. Hesketh; F/O. W. C. James; Flt. Sgt. D. R. Keast; P/O. J. W. D. Reid; P/O. D. Rimmington; P/O. J. B. Nanscawen; P/O. H. M. S. Stuart.

Royal Canadian Air Force

KILLED IN ACTION.—F/O. W. S. Anderson; Flt. Sgt. R. A. Brock; F/O. G. A. Cahoon; Sgt. J. D. Campbell; F/O. J. T. Collins; Flt. Sgt. W. H. Cook; F/O. J. H. Cowie; P/O. R. J. Cowie; P/O. J. P. Ellingson; Flt. Sgt. V. J. Fernquist; Flt. Sgt. G. H. Fetherston; F/O. K. G. Forseth; F/O. S. A. Hay; Sgt. C. E. Houston; F/O. L. I. Jones; Flt. Sgt. J. C. Laing; P/O. P. J. McBrinn; F/O. D. J. McMillan; F/O. H. J. MacMillan; P/O. J. T. McShane; P/O. R. Pierson; Flt. Sgt. E. A. H. Sills; F/O. J. C. Sinden; L.A/C. S. MacK. Smith; Flt. Lt. J. H. Somerville; Sqn. Ldr. H. K. Stinson, D.F.C.; Flt. Sgt. L. C. Tuerum; Flt. Sgt. W. C. Wilson; Flt. Sgt. G. A. Wood.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—F/O. R. G. Askew; P/O. A. F. McNally; Flt. Sgt. J. MacT. Miller.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. W. H. Giles; F/O. W. L. Nisbet.

MISSING.—Flt. Sgt. C. G. Berges; Flt. Lt. N. P. Blain; F/O. N. D. Cochrane; F/O. A. Q. Downward; P/O. A. M. Duckworth; Flt. Lt. M. Ewaschuk; F/O. W. J. K. Fisher; W/O. J. E. Fitzpatrick; Sqn. Ldr. W. M. Foster, D.F.C.; Flt. Sgt. A. M. Fostey; W/O. R. E. Fulcher; Flt. Lt. R. W. Jones; F/O. O. W. Knight; F/O. H. C. Lynch; Flt. Sgt. J. L. Macdonald; F/O. H. R. McIntyre; Sgt. A. R. McWhinney; F/O. L. H. Mahler; P/O. M. J. Martin; Sgt. A. H. Morrison; Flt. Sgt. J. F. E. Moyle; F/O. P. R. Myrick; F/O. J. R. Savard; F/O. C. Smerneos; F/O. H. Smook; F/O. D. E. Stephens; P/O. T. A. Stone; P/O. A. L. J. St. Pierre; F/Ofl. G. S. Taylor; W/O. W. C. Whitney.

Royal New Zealand Air Force

KILLED IN ACTION.—F/O. T. H. Monson.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—F/O. W. Andrews; Sqn. Ldr. F. K. Moynihan, D.F.C.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—W/O. R. F. Cottrell.

WOUNDED OR INJURED IN ACTION.—F/O. W. A. L. Trott.

MISSING, BELIEVED KILLED IN ACTION.—Sqn. Ldr. A. E. Umbers.

South African Air Force

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—Lt. J. M. Farrar.

DIED ON ACTIVE SERVICE.—Cpl. J. Stokes.

Casualty Communiqué No. 523

Of the names in this list, 109 are second entries giving later information of casualties published in earlier lists.

Royal Air Force

KILLED IN ACTION.—F/O. C. R. Bobby; Sgt. L. Harkness; W/O. R. Heel; Flt. Sgt. J. D. Lauther; Flt. Sgt. G. H. Lonsdale; W/O. D. P. G. Miller; Flt. Sgt. E. S. Thorn.

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Sgt. H. Bradbury; Sgt. L. A. Brotherton; Flt. Sgt. R. A. Budgett; Flt. Sgt. R. O. Connor; Flt. Sgt. J. H. Crane; Sgt. F. A. Farrail; Sgt. P. Gaines; Sgt. J. P. Gregory; Sgt. C. Howard; F/O. N. Morrad; Sgt. S. W. Peake; Flt. Sgt. W. Smith; Flt. Sgt. W. Smith; Sgt. I. Williams.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Sgt. J. T. Archer; Flt. Sgt. R. C. Bailey; Sgt. P. F. Beard; Sgt. T. Blacklock; Sgt. F. Booth; Sgt. B. O. Brazier; Sgt. J. B. Bull; Sgt. R. Bull; F/O. K. J. Bunn; Sgt. J. C. Burdett; P/O. M. A. Burnaby; Flt. Sgt. D. S. Campbell; Sgt. R. Catlow; P/O. J. Clegg; Sgt. G. D. Cooper; Sgt. N. L. Cooper; W/O. H. L. Cribb; Sgt. E. A. Cunningham; Sgt G. A. Danbury; Sgt. D. Davies; Sgt. E. M. Eliot; Sgt. E. G. Fidler; P/O. M. Flanagan; Sgt. W. Fletcher; P/O. J. Garside; Sgt. L. R. Gee; Sgt. J. A. Green; F/O. N. Hadley; Sgt. S. Hampson; Sgt. A. J. Holmes; P/O. T. J. Hordley; Flt. Sgt. H. E. Houldsworth; F/O. R. Kearney; F/O. J. W. Kelly; Flt. Sgt. R. G. H. Kirk; Sgt. C. G. Lee; Sgt. T. A. Liddy; Sgt. R. Liderth; Sgt. G. R. McKnight; P/O. W. C. McLeod; Flt. Sgt. W. F. Martin; Sgt. L. D. Maynard; Sgt. L. R. Melbourne; Flt. Sgt. P. J. Mosley-Leigh; Sgt. D. Nelson; Sgt. G. O'Leary; Flt. Sgt. V. J. Pickford; Flt. Sgt. H. B. Pounder; Sgt. G. P. Rae; Sgt. F. G. Rees; Sgt. R. A. Renwick; F/O. T. Rich; Flt. Sgt. C. H. Richardson; Flt. Lt. R. Richmond; Sgt. W. M. Rivers; Sgt. B. J. Rosch; P/O. J. M. Roberts; Flt. Sgt. P. C. Robins; Flt. Sgt. W. Rose; Sgt. I. H. Ross; Sgt. R. E. Royal; Flt. Sgt. J. W. Schofefield; Sgt. G. R. Small; Sgt. T. A. Smith; Flt. Sgt. C. R. Taylor; Flt. Sgt. J. Thompson; Sgt. W. R. Tomlinson; Sgt. S. L. Toon; Sgt. R. A. G. Turner; Sgt. G. Walker; Sgt. J. S. Webster; Sgt. S. W. Wheeler; P/O. J. M. Whiting.

WOUNDED OR INJURED IN ACTION.—Flt. Sgt. M. J. Vinall.

MISSING, BELIEVED KILLED IN ACTION.—Flt. Lt. R. V. Heath, D.F.C.

MISSING.—P/O. A. J. Adams; W/O A. Adamson; F/O. K. C. Allan; Sgt. C. R. Anderson; Flt. Sgt. P. F. Andrews; Flt. Lt. J. Barritt, D.F.C.; Sgt. W. Barwise; Sgt. W. J. Belton; Sgt. J. Benson; Flt. Sgt. A. J. Berry; Sgt. P. Blake; Flt. Sgt. C. J. Bridgett; P/O. J. S. Cameron; Sgt. J. C. Cape; F/O. R. Carabine; Sgt. A. Carson; P/O. S. Chaderton; Sqn. Ldr K. L. Collinson, D.F.C.; Sgt. A. Colville; Sgt. H. G. Davies; Sgt. J. Davies; Sgt. K. F. Day; Flt. Sgt. N. Earnshaw; Sgt. S. W. Ede; Sgt. G. J. Edwards; Sgt. E. A. Emery; Sgt. J. L. Fallows; Flt. Sgt. V. E. Filaratoff; W/O. A. G. Flack; Sgt. L. L. Foster; F/O. E. S. Fraser; Sgt. R. L. Gard; Sgt. P. Garner; Sgt. G. G. Gibb; F/O. J. Grayshan; Flt. Sgt. A. G. Greive; Flt. Lt. D. Grisdale; Sgt. H. W. J. Hardy; Flt. Sgt. A. C. Harrison; Flt. Sgt. W. W. Hewitt; F/O. E. C. Hill; Flt. Sgt. R. J. H. Jackson; Sgt. R. W. Jarvis; Sgt. J. Johnston; Flt. Sgt. W. Langstaff; Flt. Lt. J. B. M. Liddell; Flt. Lt. W. M. Lightbourn; Sgt. R. Lister; Sgt. G. F. Longley; Flt. Sgt. B. Longworth; Flt. Lt. J. C. R. McCallum; Flt. Sgt. J. McCreadie; Flt. Sgt. A. J. McKay; Sgt. R. Marriott; Sgt. D. K. W. Mayes; Flt. Sgt. J. R. Mears; Flt. Sgt. C. E. Miller; F/O. J. R. M. Mills; Flt. Sgt. J. A. Oakes; Sgt. N. W. Oates; F/O. M. A. O'Callaghan; Flt. Lt. J. G. Padgham; Sgt. R. Palmer; P/O. R. L. Parsons; F/O. H. E. J. Perry; Sgt. W. E. Pickering; Flt. Sgt. W. R. Powell; F/O. R. E. Proudley; Sgt. F. H. Riches; Sgt. J. R. Ridsdale; Flt Lt. J. W. Robb, D.F.C.; F/O. G. A. Robertson; Sgt. S. Rosenthal; Flt. Sgt. G. F. Sage; Sgt. L. E. Sayer; Sgt. P. L. W. Scott; Flt. Sgt. L. F. F. Scull; F/O. J. M. Sinclair; L.A/C. F. Snowden; Flt. Sgt. J. W Stazaker; F/O. A. C. Strachan; Flt. Sgt. G. Summers; P/O. S. I. Taylor; Sgt. T. E. Teanby; Wing Cdr. R. R. Thomson, D.F.C.; P/O. T. F. Townley; P/O. R. P. Townsend; Sgt. F. W. Wakefield; Flt. Sgt. H. M. Watson; Sgt. B. Whitfield; F/O. D. E. G. Williams;; Sgt. F. E. Wright.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—Flt. Lt. E. S. Allen; P/O. J. R. Byrne; Flt. Sgt. A. B. Dennison; W/O. R. H. Kent; Flt. Sgt. G. A. Maginley; Sgt E. T. Smith.

KILLED ON ACTIVE SERVICE.—Cpl. K. S. Anderson; Sgt. K. B. Bain; Flt. Sgt. A. Barton; Flt. Lt. D. W. Bidder; Flt. Sgt. P. N. R. Carr; A/C.2 W. J. Colby; Sgt. W. G. Cornish; Sgt. P. N. Ellis; Flt Lt. T. A. Evans; Flt. Sgt. E. E. Evershed; Sgt. M. V. Gilder; Flt. Lt. V. G. Haley; Flt. Lt. J. Heywood; Sgt. R. E. Jelfs; Sgt. J. A. McKaine; Sgt. D. Mayers; F/O. J. E. Murray-Shirreff; W/O. N. L. P. Quinn; Flt. Sgt. L. D. Slipper; A/C.2 R. E. Suggars; F/O. E. Timperley; F/O. W. M. Tullett; F/O. S. G. Williams.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—P/O. E. B. Machell; F/O. H. Merrill.

WOUNDED OR INJURED ON ACTIVE SERVICE.—A/C.1 D. Hodson; L.A/C. J. Maloney; L.A/C. G. T. Norris; Cpl : E. T. Povey; L.A/C. J. L. Ringrose; L.A/C. E. Sellers; L.A/C. T. C. Webb.

DIED OF WOUNDS OR INJURIES RECEIVED ON ACTIVE SERVICE.—L.A/C. M. Donechy; Cpl. J. P. O'Neill; L.A/C. R. E. Swift; Cpl. W. Taggart.

DIED ON ACTIVE SERVICE.—Flt. Lt. F. Binns; Flt Sgt. C. H. Bowden; L.A/C. J. E. Brand; L.A/C. J. L. Clark; Flt. Lt. T. J. Davies; Cpl. L. Drummond; L.A/C. P. E. Gentry; L.A/C. A. F. Hepher; L.A/C. K. H. Hodgson; L.A/C. W. J. Inman; L.A/C. C. Jeans; A/C.2 H. Knox; L.A/C. F. M. Le-Bosse; Cpl. J. F. McQueen; Sgt. L. H. Morgan; A/C.1 D. Morley; A/C.1 G. H. Parton; L.A/C. L. W. Phillips; Flt. Lt. H. C. Shrubsole; Sgt. R. G. E. Smith; L.A/C W. R. Walden; L.A/C. E. G. Wood.

Women's Auxiliary Air Force

MISSING, BELIEVED KILLED ON ACTIVE SERVICE. L.A/CW. M. H. Elwell.

Royal Australian Air Force

PREVIOUSLY REPORTED MISSING, BELIEVED KILLED IN ACTION, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. R. H. Cato; P/O. A. L. Coates; F/O. A. R. Craine; Flt. Sgt. S. N. Kelly; P/O. R. J. Peggs; W/O. P. V. Waddell.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED IN ACTION.—Flt. Sgt. E. A. Birrell; P/O. J. C. Fardon; P/O. J. W. Gardner; F/O. D. M. Gow; P/O. D. A. Hayman; P/O. A. J. N. Hockley; Flt. Sgt. A. C. Johns; F/O. J. C. Low; Flt. Sgt. P. F. McCaughey; Flt. Lt. C. J. Martin; F/O. J. F. Savage; Flt. Sgt. G. Washbourne; Flt. Sgt. E. Wilkins.

MISSING.—Flt. Sgt. M. J. Coleman; F/O. N. C. Fernley-Stott; Flt. Sgt. K. G. Fogarty; Flt. Sgt. D. C. Hannaford; W/O. A. E. W. Knight; P/O. D. J. Lewis; P/O. T. B. McManus; F/O A. Wallwork; Flt. Sgt. A. M. White; Flt. Sgt. B. T. T. Wilson.

KILLED ON ACTIVE SERVICE.—Flt. Sgt. C. W. Saunders; F/O. G. C. Wiggins.

PREVIOUSLY REPORTED MISSING, NOW PRESUMED KILLED ON ACTIVE SERVICE.—Flt. Sgt. G. T. Wilks

Royal Canadian Air Force

MISSING.—F/O. J. Armitt; F/O. E. D. Brown; Flt. Lt. W. C. Charde; F/O. E. W. Connolly; W/O. J. A. T. Dick; P/O. R. A. French; W/O. J. E. Gallop; F/O. F. M. Gordon; F/O. J. A. Kaucharik; F/O. D. S. Kemp; Flt. Lt. J. K. Knights, D.F.C.; F/O. D. B. Olson; F/O. F. A. Nixon.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE. —P/O. G. L. Mulhall.

KILLED ON ACTIVE SERVICE.—Flt. Lt. J. Carr; F/O. S. A. W. Hepburn; Flt Lt J. W. Hobbs; F/O. R. Kukurski.

DIED ON ACTIVE SERVICE.—P/O. T J Lothian; L.A/C. V. G. Mattson.

South African Air Force

MISSING.—Lt. G. R. Lacey.

KILLED ON ACTIVE SERVICE.—2nd Lt. J W. George.